



Data From the Skies Warn of Disasters on the Ground

Dr. Maggi Glasscoe

Jet Propulsion Laboratory, California Institute of Technology

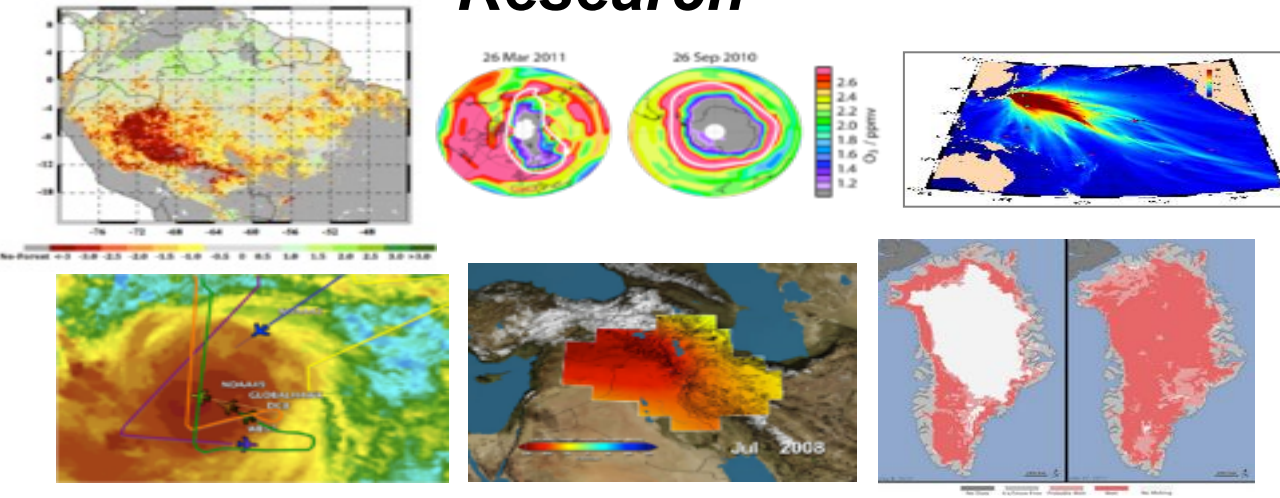
***2018 California Science Education Conference
30th November 2018
Pasadena, CA***



About NASA Programs
Observations
Earthquakes
Wildfires

NASA Earth Science Division

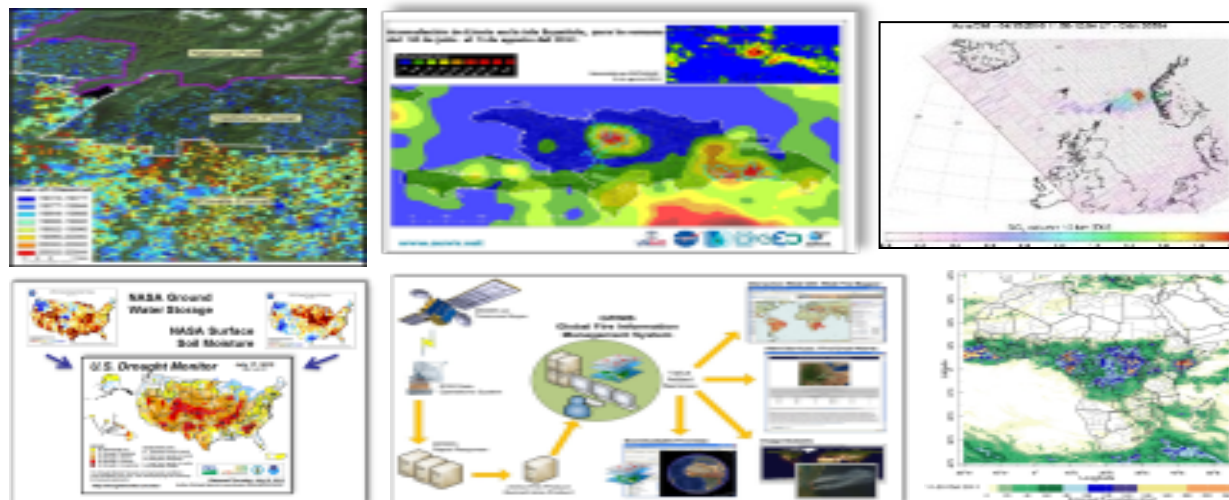
Research



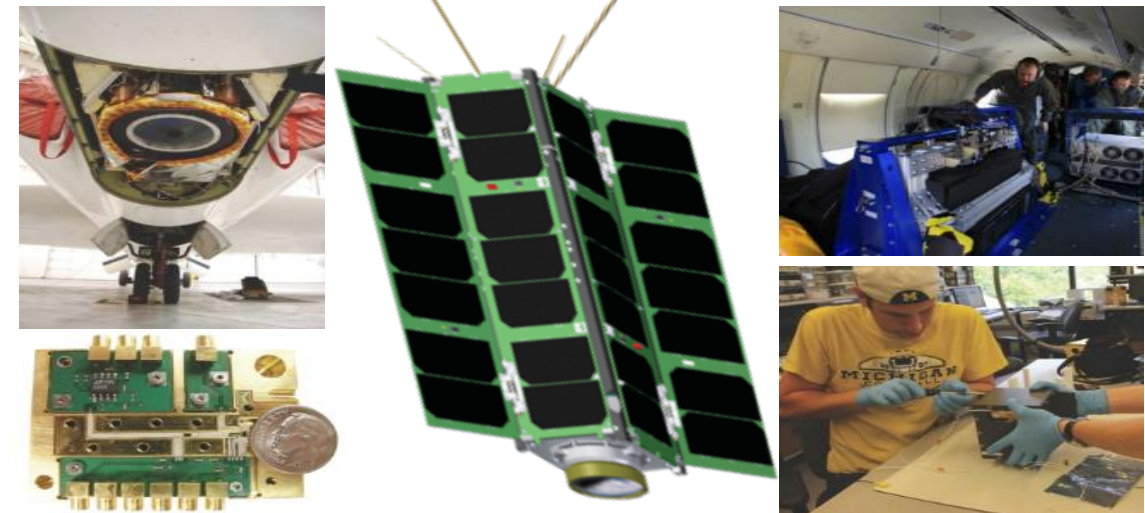
Flight



Applied Sciences



Technology



Applications Themes & Societal Benefit Areas

Emphasis in 4 Applications Areas



Health &
Air Quality



Water Resources



Disasters

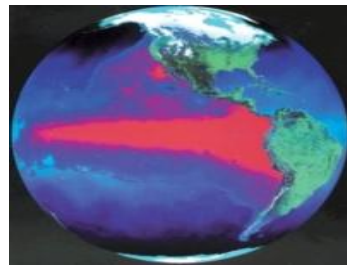


Ecological
Forecasting

Support opportunities in 5 additional areas



Agriculture



Climate



Weather



Energy



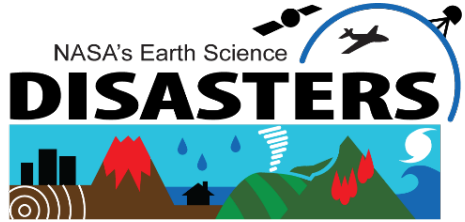
Oceans



Crosscutting theme:
Wildland Fires



NASA Applied Science: Disasters



<https://disasters.nasa.gov>

<https://maps.disasters.nasa.gov>

The Disasters Applications area promotes the use of Earth observations to improve prediction of, preparation for, response to, and recovery from natural and technological disasters. Disaster applications and applied research on natural hazards support emergency preparedness leaders in developing mitigation approaches, such as early warning systems, and providing information and maps to disaster response and recovery teams.

- The Program targets a spectrum of disasters, including floods, earthquakes, volcanoes, and landslides as well as combined hazards and cascading impacts.
- The Program has Coordinators at NASA HQ and across NASA Centers to enable generation and delivery of data and products to end-users during disaster event activations.
- Since NASA is not an operational agency, the Disasters Program activates during an event upon an end-user request
- Products are shared directly to the end-user, posted to the Disasters website, and through the Disasters Geoportal.



Earthquakes



Volcanoes



Landslides



Floods



Fires

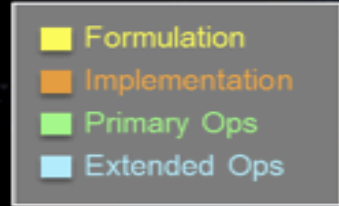


Land Subsidence



Space and Airborne Observations

NASA Satellite Constellation



Sentinel-6A/B (2020_2025)

Earth Science Instruments on ISS:

CATS, (2020)

LIS, (2018)

SAGE III, (2017)

TSIS-1, (2018)

ECOSTRESS, (2018)

GEDI, (2018)

OCO-3, (2018)

CLARREO-PF, (2020)

TSIS-2 (2020)

MAIA (~2021)

TROPICS (~2021)

EVM-2 (~2021)

PACE (2022)

NISAR (2022)

SWOT (2021)

TEMPO (2018)

JPSS-2 (NOAA)

RBI, OMPS-Limb (2018)

GRACE-FO (2) (2017)

ICESat-2 (2018)

CYGNSS (2016)

ISS

SORCE, (2017)

TCTE (NOAA)

NISTAR, EPIC (2019)

(NOAA'S DSCOVR)

QuikSCAT (2017)

EO-1 (2017)

Landsat 7 (USGS)

(~2022)

Terra (>2021)

Aqua (>2022)

SMAP (>2022)

Suomi NPP (NOAA) (>2022)

Landsat 8 (USGS) (>2022)

CloudSat (~2018)

CALIPSO (>2022)

Aura (>2022)

GRACE (2) (2018)

OSTM/Jason 2 (>2022)

(NOAA)

OCO-2 (>2022)

GPM (>2022)

NASA Airborne Science Fleet

<https://airbornescience.nasa.gov/>

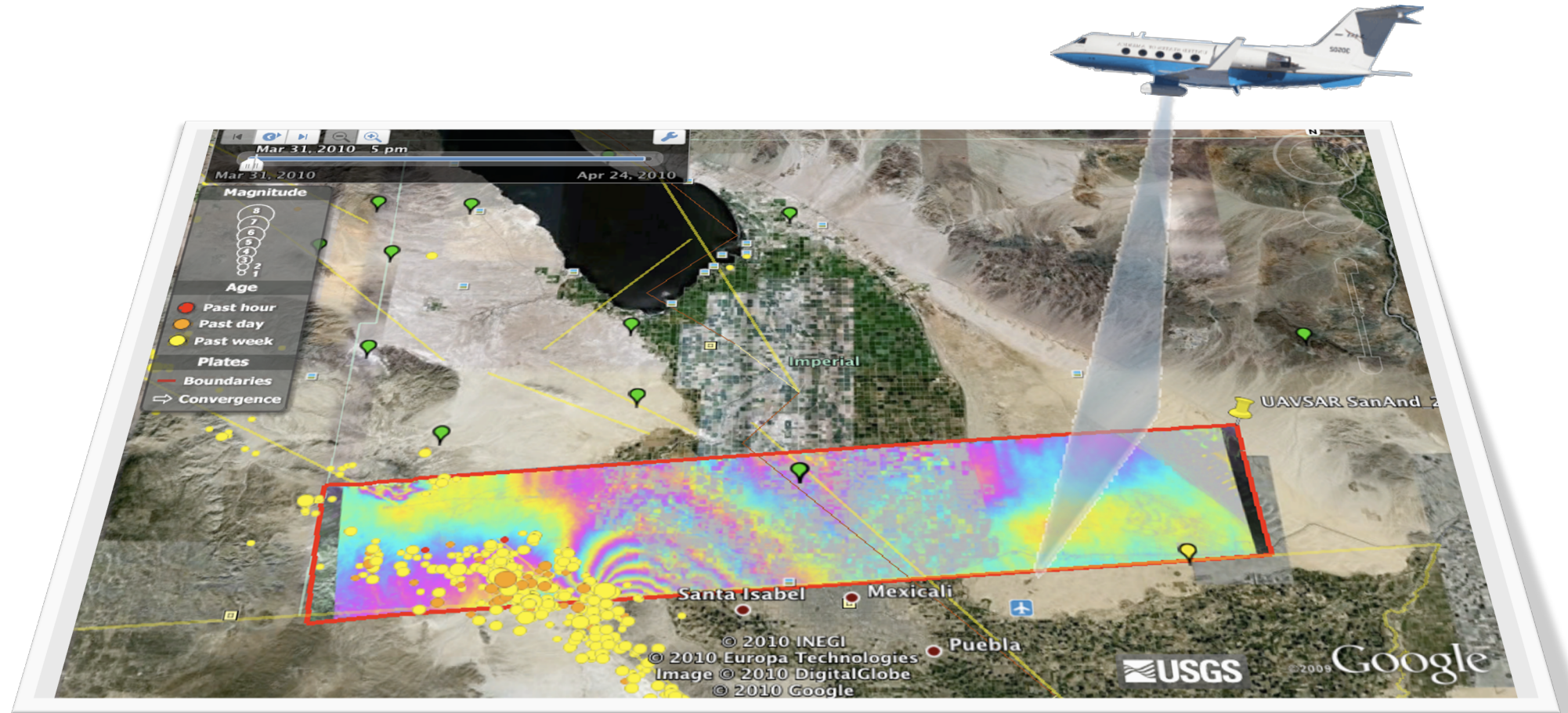


UAVSAR

- NASA's Airborne Interferometric Synthetic Aperture Radar Platform
- Flown on a Gulfstream-III
- 12.5 km altitude
- Repeat pass interferometry



UAVSAR/InSAR



Products provide ground changes in a line of sight direction to/from the instrument

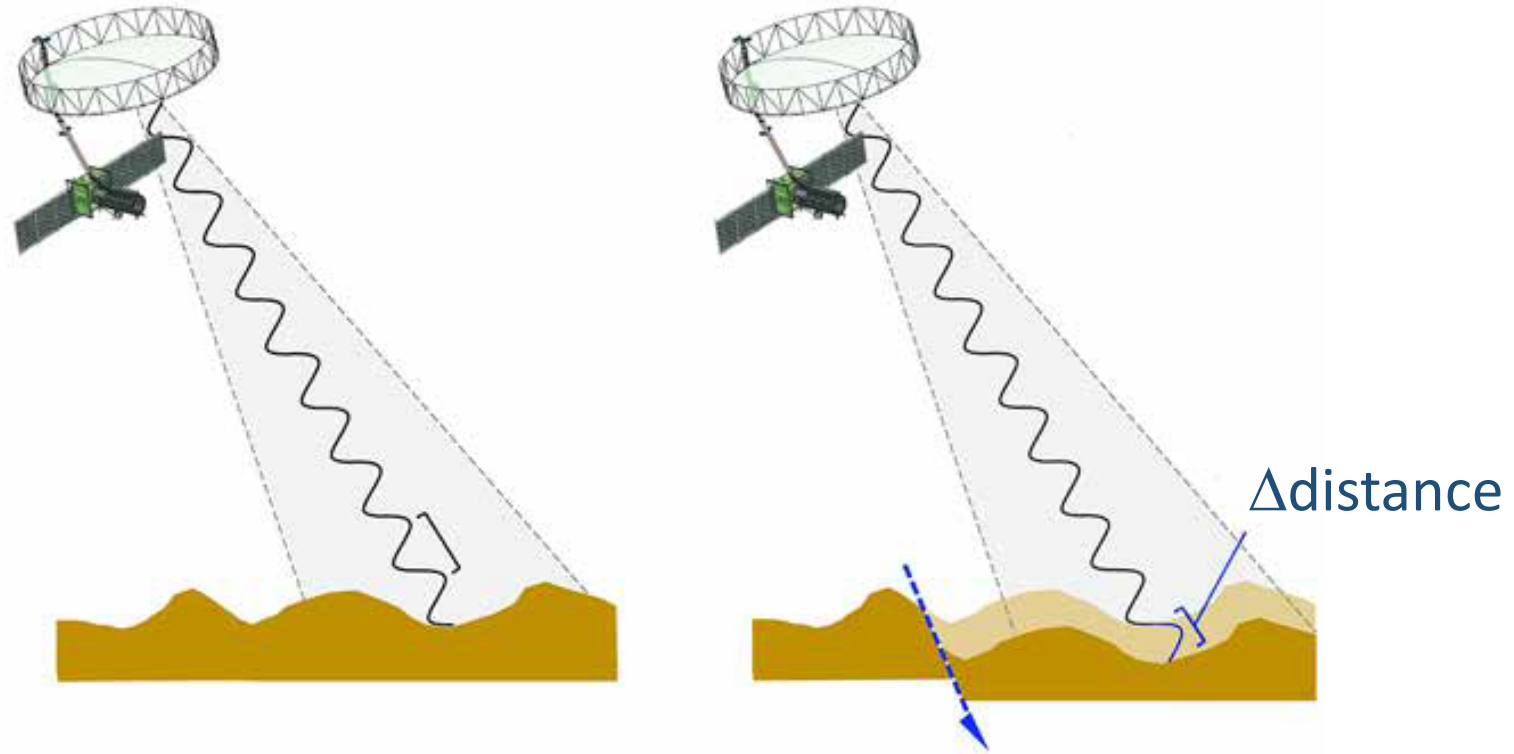
UAVSAR/InSAR

UAVSAR

- Airborne InSAR
- L-band (24 cm wavelength)
- Repeat pass interferometry
- Flown on a Gulfstream III
- Color cycle is 12 cm

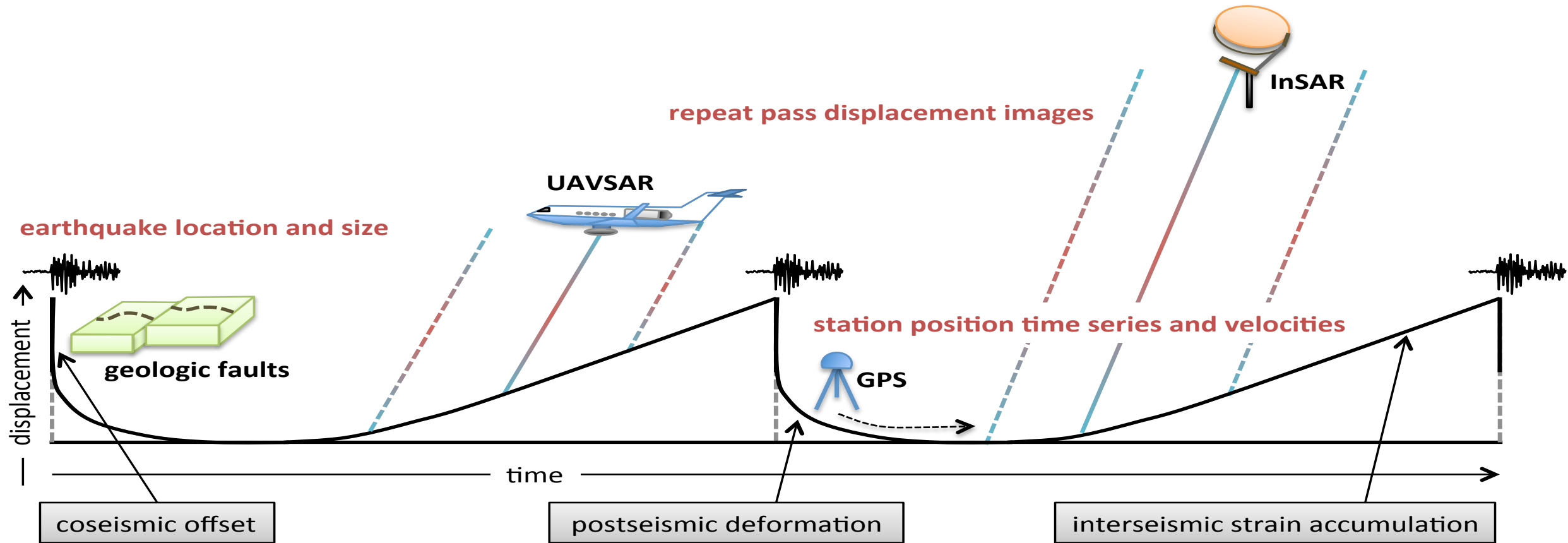


InSAR Measures Phase Difference



Converted to line of sight range change measurement

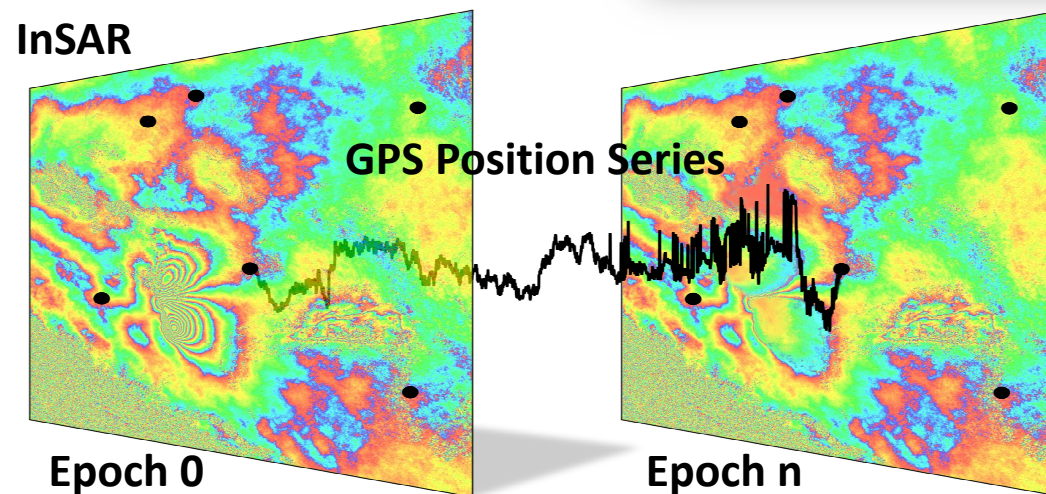
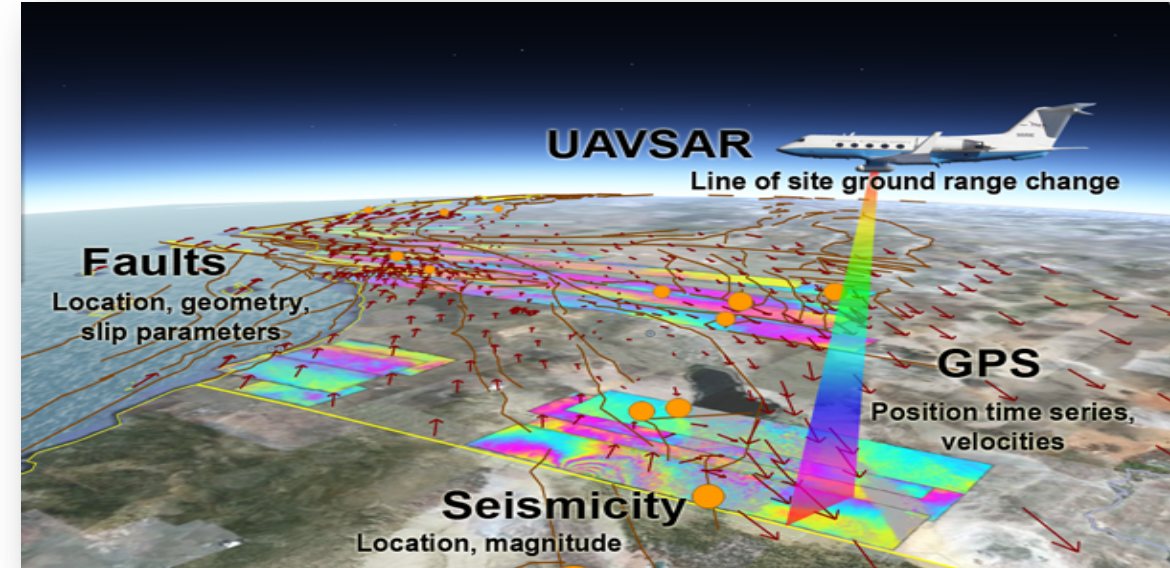
Geodesy Observes the Earthquake Cycle



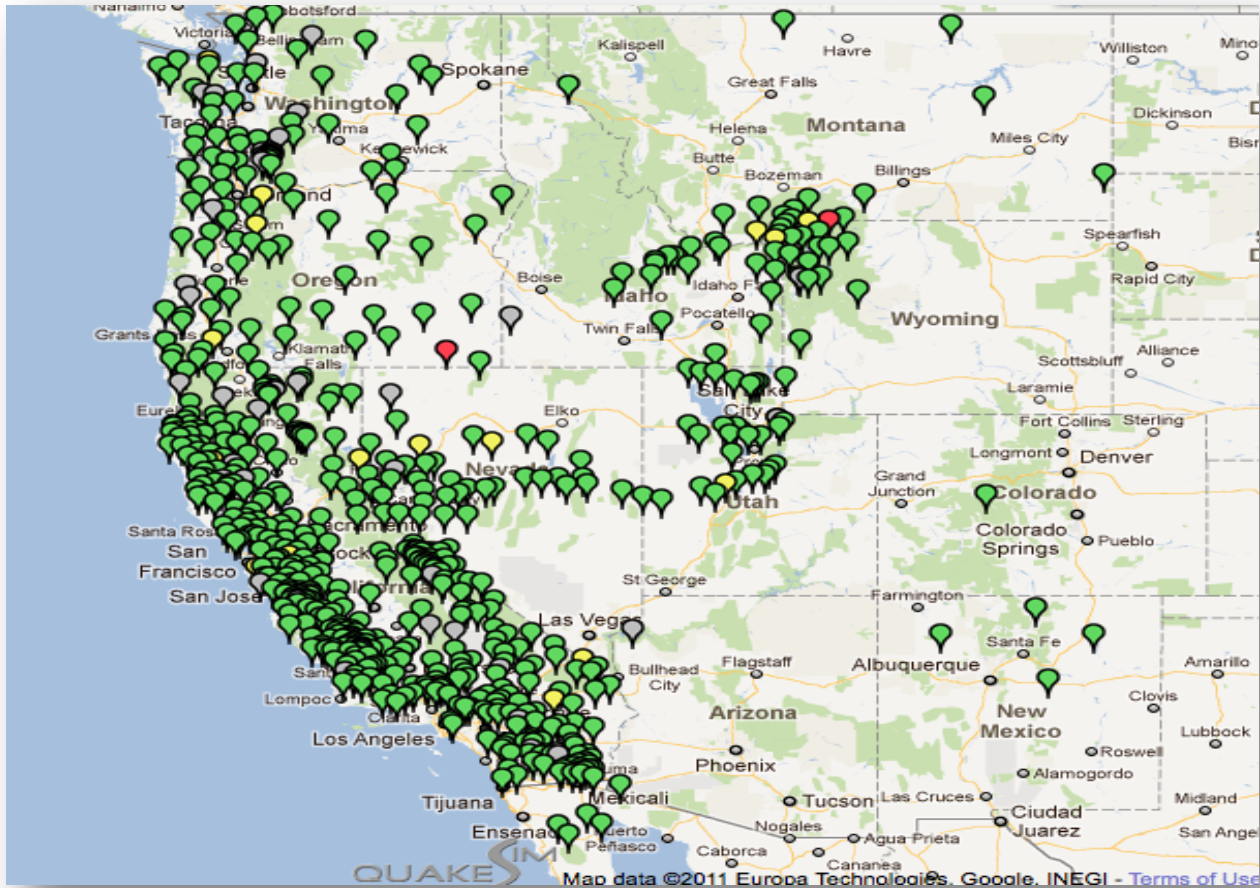
Strain accumulation and release

Geodetic Imaging Products

- GPS
 - Smooth in time, not space
- InSAR
 - Smooth in space, not time



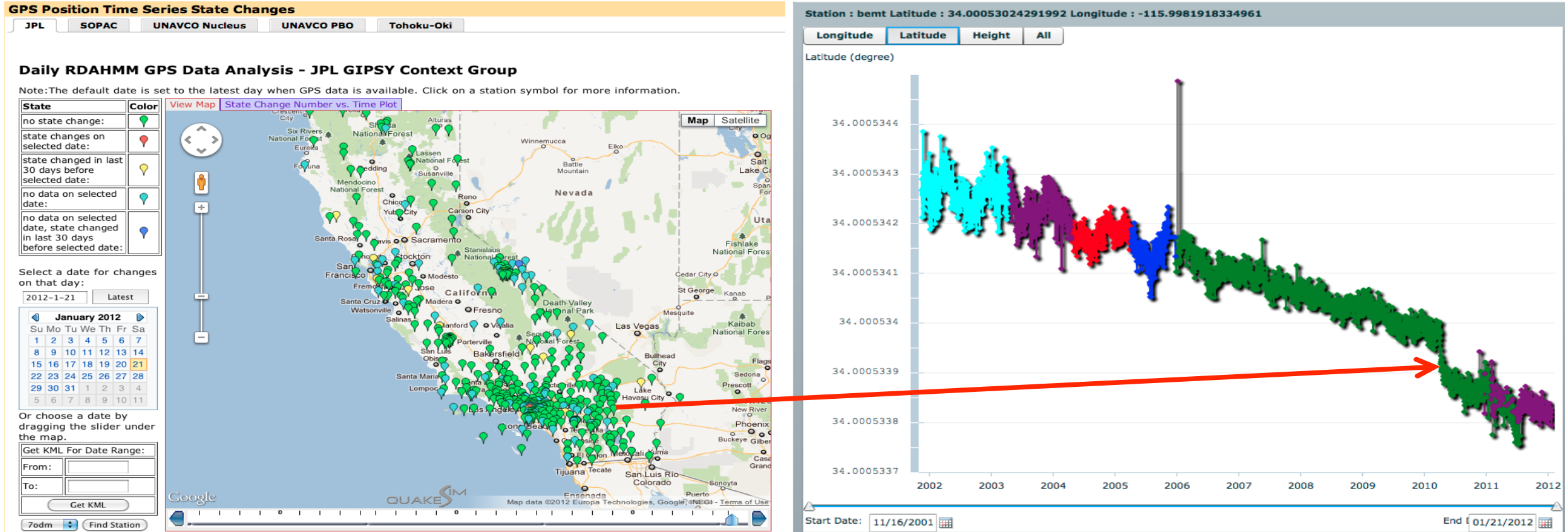
GPS



Horizontal position accuracy 1 mm
Vertical position accuracy 2 mm
1 mm/yr horizontal velocities



GPS Position Time Series Analysis



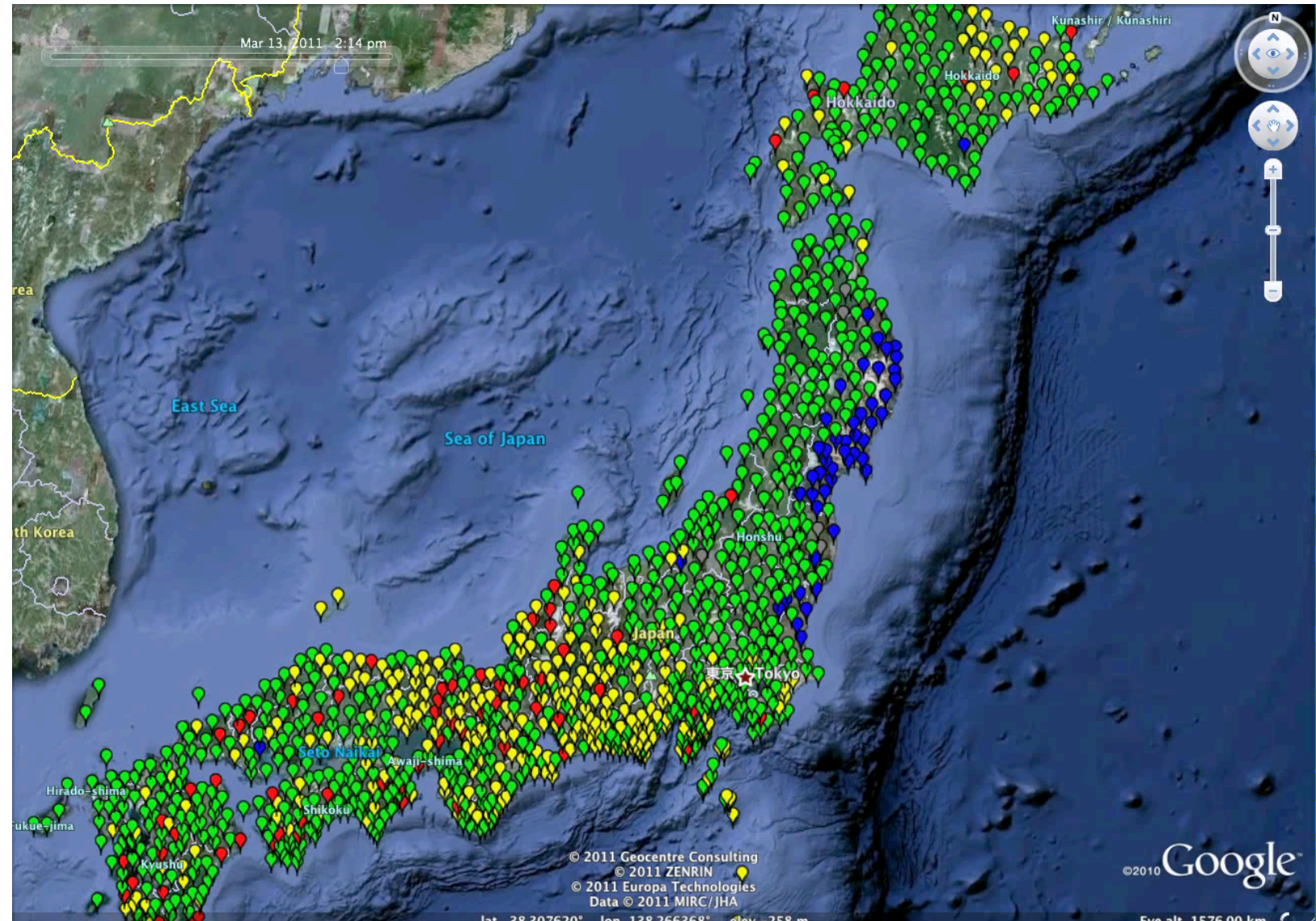
Substantial postseismic motion northeast of the El Mayor – Cucapah Rupture

California GPS Deformation



GPS Station State Changes in the Tohoku-oki Earthquake

- GPS station state can be analyzed for anomalous behavior
- In the case of the Tohoku-oki earthquake, the Japanese GPS network, one of the densest in the world, could be seen changing state as a result of the propagation of the seismic waves through the network
- Analysis of large data sets allows us to see behavior of networks such as these, expanding datasets into interpretation of tectonic (or non-tectonic) effects

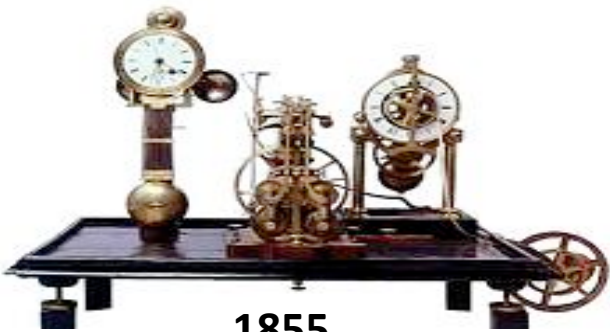




Earthquakes

A Brief History...

Luigi Palmieri, Italy



1855

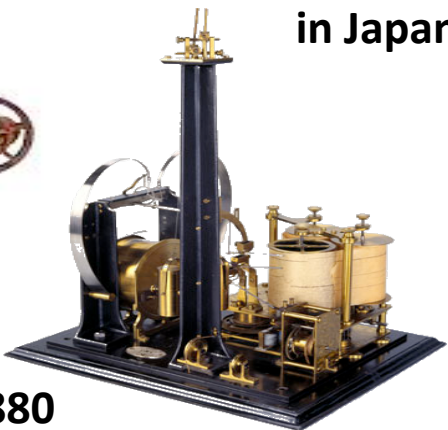
China Seismometer
Time, Duration
Intensity



132

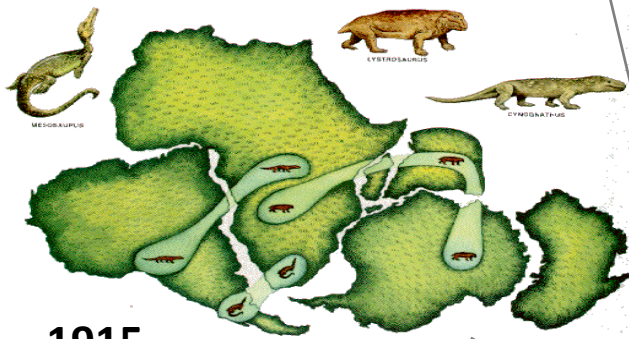
Direction

Milne, Ewing, Gray:
British professors
in Japan



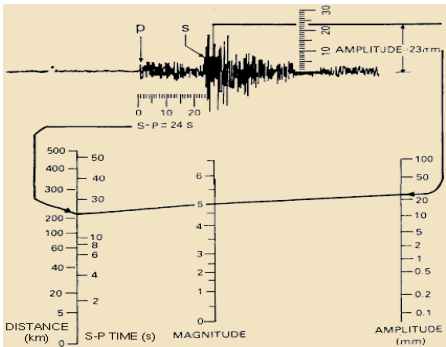
1880
Waveforms

Wegner



1915
Continental Drift

Richter Scale



1935

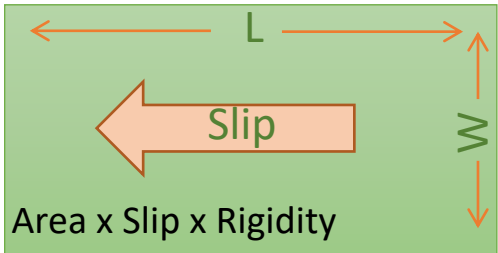
Intensity of earthquake



1984

Measured plate
tectonics

Hanks & Kanamori



1979

Moment Magnitude

AD

0

500

1000

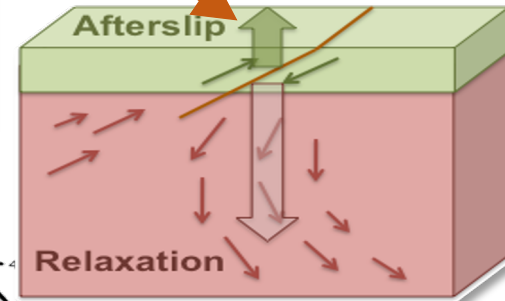
1500

2000

Earthquakes Occur Over Many Timescales

Strain accumulation –
kilometers/decades

Earthquakes – nucleate over
meters/milliseconds



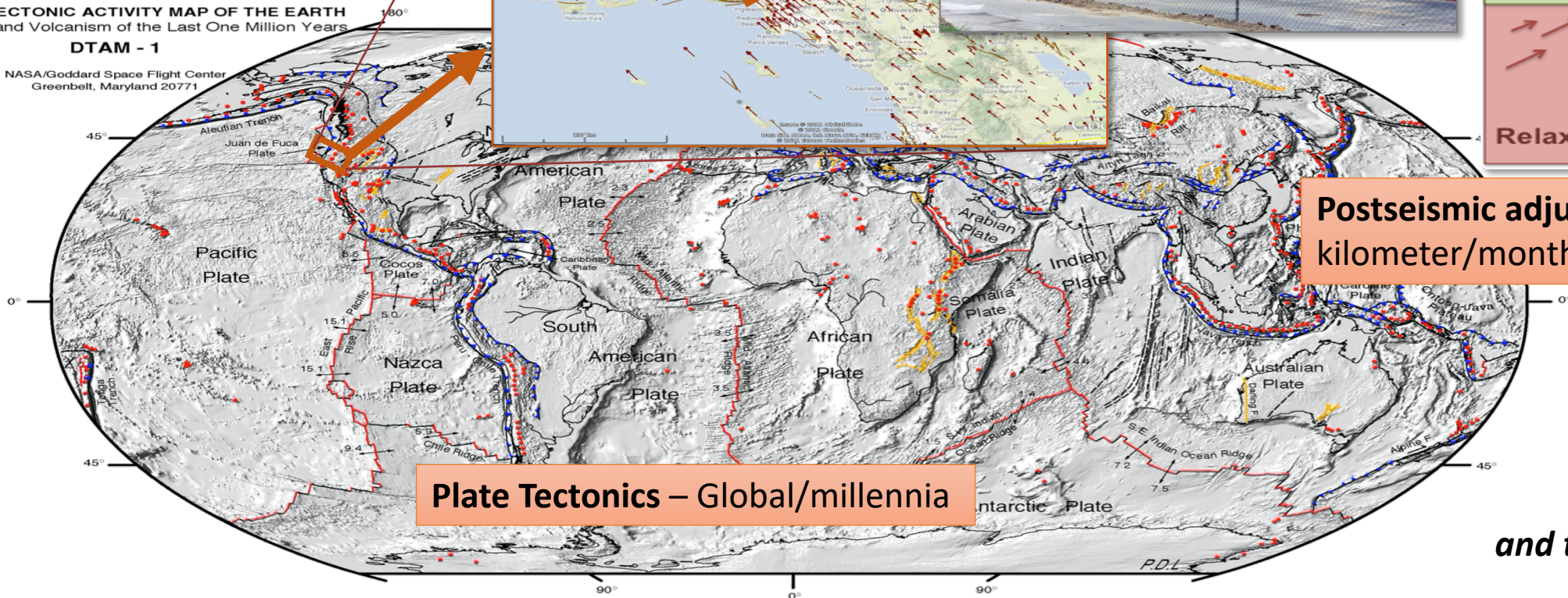
Postseismic adjustment –
kilometer/month scales

Plate Tectonics – Global/millennia

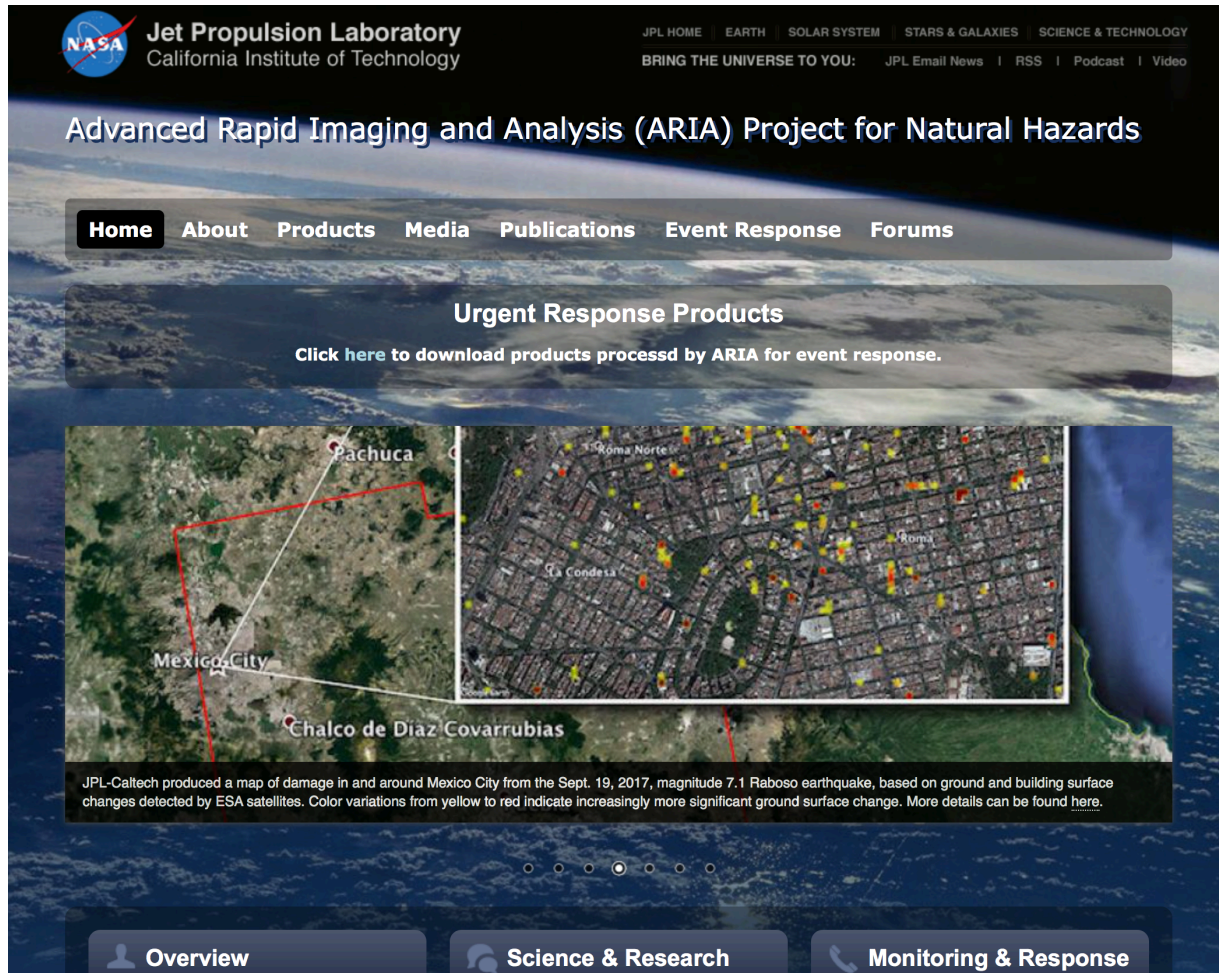
**Magnitude 7
in California:
\$200-300B losses
and thousands of lives**

DIGITAL TECTONIC ACTIVITY MAP OF THE EARTH
Tectonism and Volcanism of the Last One Million Years
DTAM - 1

NASA/Goddard Space Flight Center
Greenbelt, Maryland 20771



ARIA – Advanced Rapid Imaging and Analysis



- ARIA is a collaboration between JPL and Caltech to exploit radar and optical remote sensing, GPS, and seismic observations for hazard science and response.
- ARIA investigates the processes and impacts of earthquakes, volcanoes, landslides, fires, subsurface fluid movement and other natural hazards by applying modern geodesy, merged with ground-based observations, to help improve our resilience to such events.
- The project develops state-of-the-art ground deformation measurements change detection methods and physical models using GPS and synthetic aperture radar observations, automating the required large-scale processing, and producing basic data products for the science community.

2017 Mexico Earthquakes

The screenshot shows the NASA Disasters Program website. At the top, there's a header with the NASA Earth Science logo, the NASA Applied Sciences Program name, the website URL (www.nasa.gov), and a search bar. Below the header, there's a navigation menu with links to ORGANIZATION, DISASTERS, PRODUCTS, and RESOURCES. The main content area features a large map of Mexico with a text overlay about the Project Mekong App using MODIS imagery to show inundation over land. To the right of the map is a 'Recent Disasters' list including Mount Agung Volcano Monitoring 2017, Typhoon Damrey 2017, California Wildfires 2017, Hurricane Maria 2017, Mexico City Earthquake 2017, Southern Mexico Earthquake 2017, Hurricane Irma 2017, Hurricane Harvey 2017, Montenegro Wildfires 2017, and Venezuela Flooding 2017. Below the map is a section titled 'About the NASA Disasters Program' with a background image of a volcano and a brief description of the program's goals. At the bottom, there are three columns: 'Community' featuring logos for FEMA, Pacific Disaster Center, and USAID; 'Organization' listing the team and NASA organizations; and 'Resources' with links to Products, Meetings, and Training. The footer contains contact information for David Green and Jacob Reed, along with links to the site map, media requests, and privacy policy.

NASA Earth Science
DISASTERS PROGRAM
NASA Applied Sciences Program | www.nasa.gov
Search

ORGANIZATION DISASTERS PRODUCTS
RESOURCES

November 13, 2017
Project Mekong App uses MODIS Imagery to Show Inundation over land.
Inundation Layer from Project Mekong App as of 11/10/2017. Current inundation layer from the Project Mekong App as of 11/10/2017. Red indicates areas with detected flooding. The application uses LANCE MODIS imagery (collected today, 11/10/2017) and applies a dynamic surface...
Read More

Recent Disasters
Mount Agung Volcano Monitoring 2017
Typhoon Damrey 2017
California Wildfires 2017
Hurricane Maria 2017
Mexico City Earthquake 2017
Southern Mexico Earthquake 2017
Hurricane Irma 2017
Hurricane Harvey 2017
Montenegro Wildfires 2017
Venezuela Flooding 2017
View All

About the NASA Disasters Program
The Disasters Applications area promotes the use of Earth observations to improve prediction of, preparation for, response to, and recovery from natural and technological disasters. Disaster applications and applied research on natural hazards support emergency preparedness leaders in developing mitigation approaches, such as early warning systems, and providing information and maps to disaster response and recovery teams.
Learn More

Community
FEMA
PACIFIC DISASTER CENTER
USAID
More...

Organization
The Team
• Org Chart
• Disaster Response Coordination Team
• Monthly Status Reports (MSR)
• Contact Us
• News
NASA Organizations:
• NASA HQ
• NASA Applied Sciences
• NASA Earth Science
More...

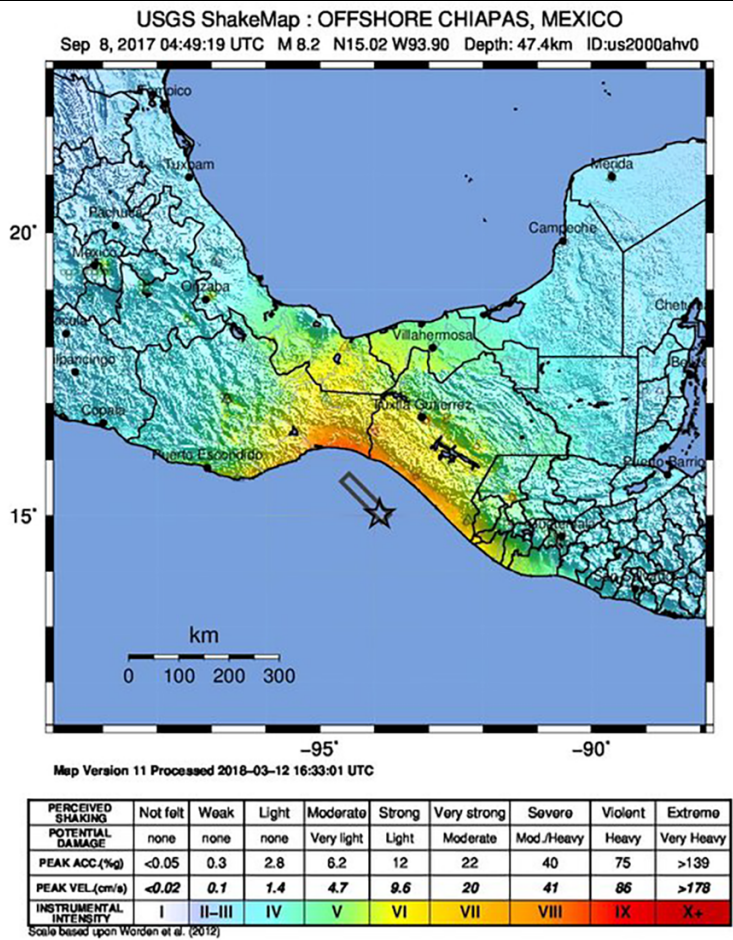
Resources
Products
Meetings
Training
More...

NASA HQ Official: David Green
Web Curator: Jacob Reed
NASA Media Usage Policy
Privacy Policy & Notices
Contact Us
Site Map
Media Requests
www.nasa.gov

The 8 September M 8.1 Tehuantepec earthquake, the largest earthquake recorded in Mexico over the last 100 years, and the 19 September M 7.1 Puebla earthquakes both caused widespread damage, affecting several million people and causing numerous casualties.

A NASA Disasters team activated soon after these devastating earthquakes in order to support decision makers in Mexico, using NASA modeling and international remote sensing capabilities to generate decision support products to aid in response and recovery.

M 8.1 Tehuantepec Earthquake



The 8 September M 8.1 Tehuantepec earthquake was the largest earthquake recorded in Mexico over the last 100 years

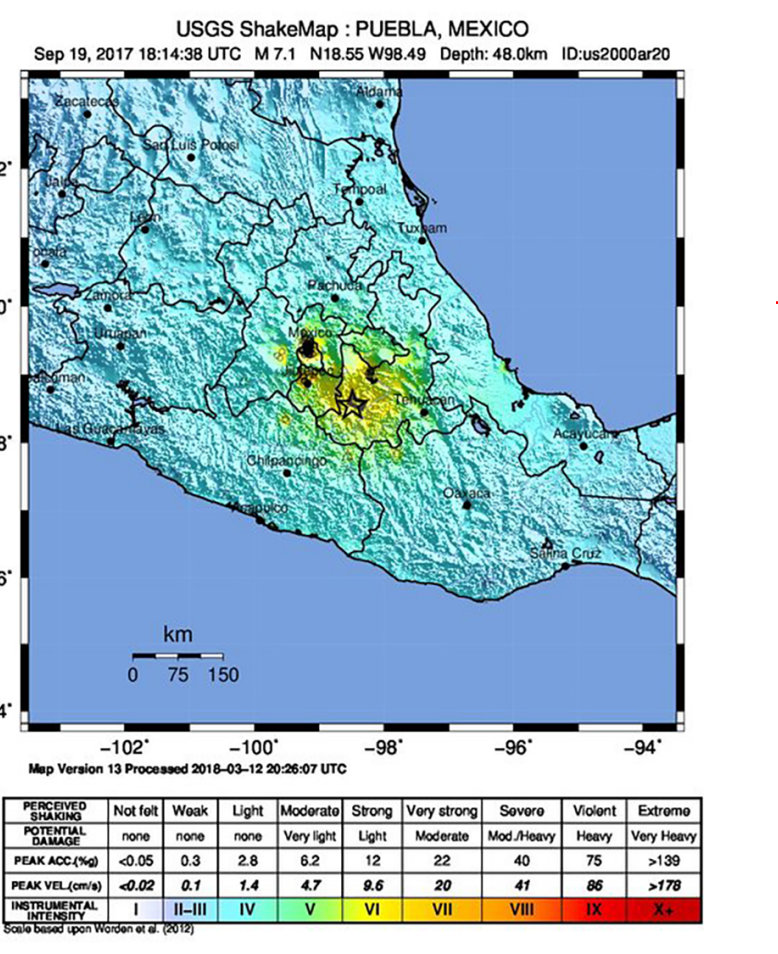


Photo credit: Presidencia de la República Mexicana, CC-BY-2.0

It generated a tsunami and several aftershocks, affected millions of people damaged thousands of homes, and caused nearly 100 casualties.

Pictured above, Mexico’s former President Enrique Peña Nieto is inspecting damage to a home in Juchitán, Oaxaca

M 7.1 Puebla Earthquake



Just over a week later, the Puebla earthquake struck on 19 September 2017, causing numerous fatalities, building collapses and widespread damage.

The earthquake damaged buildings in the states of Puebla and Morelos as well as in Mexico City.

The picture above shows a collapsed building in Mexico City.

NASA Earth Sciences Disasters Program Support



The screenshot shows the NASA Earth Sciences Disasters Program website. The header includes the NASA logo, the program name, and navigation links for ORGANIZATION, DISASTERS, PRODUCTS, and RESOURCES. The main content area is titled "Southern Mexico Earthquake 2017" and includes a "Disaster Types" section with "Earthquakes" listed. The "Overview" section describes an M 8.1 offshore Chiapas Mexico earthquake on September 8, 2017. The "Latest Updates" section features a "Sentinel-1 Radar Shows Ground Motion due to September 2017 Oaxaca-Chiapas Earthquake in Mexico" with a map and a "Read More" link.

NASA Earth Science
DISASTERS PROGRAM

NASA Applied Sciences Program | www.nasa.gov

Search

ORGANIZATION DISASTERS PRODUCTS
RESOURCES

Southern Mexico Earthquake 2017

Southern Mexico Earthquake 2017

Disaster Types

Earthquakes

Start Date

September 8, 2017

Overview

A M 8.1 offshore Chiapas Mexico occurred at 2017-09-08 04:49:21 UT. This was an intermediate depth earthquake with an estimated source depth of approximately 70 km. This was the largest of 9 earthquakes M7.0 and larger within 250 km in the past century. The largest reported shaking by USGS Did you feel it? was MMI VIII (Moderate-Heavy Shaking) roughly 200 km from the epicenter. There was an initial tsunami warning, but the threat has now passed (<http://www.tsunami.gov/>). There have been at least 20 M4 or greater aftershocks in the region. For more details on the event, please go to: <https://earthquake.usgs.gov/earthquakes/eventpage/us2000ahv0#executive>. NASA is coordinating with relevant agencies for this disaster to provide support for this event.

Latest Updates

September 14, 2017

Sentinel-1 Radar Shows Ground Motion due to September 2017 Oaxaca-Chiapas Earthquake in Mexico

NASA and its partners are contributing important observations and expertise to the ongoing response to the September 7, 2017 (local time), magnitude 8.1 Oaxaca-Chiapas earthquake in Mexico. This earthquake was the strongest over a century for Mexico. It has caused a significant humanitarian crisis with widespread building damage and triggered landslides throughout the region. Scientists with the Advanced Rapid Imaging and Analysis project (ARIA), a...

Read More

September 14, 2017

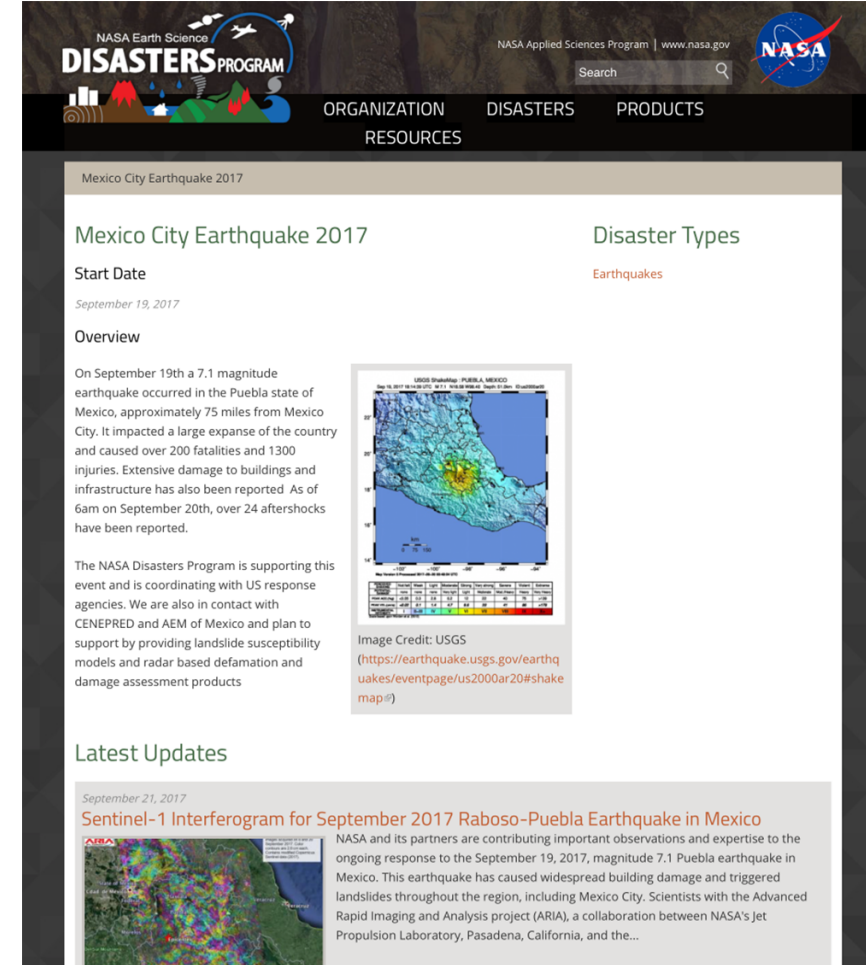
Landslide Maps for the 2017 Mexico Earthquake

The global Landslide Based Assessment for Situational Awareness (NASA) model is

<https://disasters.nasa.gov/mexico-earthquake-2017>

The Disasters Program website offers information about the Program, as well as event activations. Individual events have pages where summary information and products are listed.

The Disasters Program activated for the two September 2017 earthquakes. Event pages were created for each with summaries and products. The Program supported both domestic and international partners responding to the event. We worked with Mexico's space agency (AEM), the National Center for Prevention of Disasters (CENAPRED), and NASA scientists. We also worked with academic partners, technical institutions, and field responders, including the USGS and OFDA.



The screenshot shows the NASA Earth Sciences Disasters Program website. The header includes the NASA logo, the program name, and navigation links for ORGANIZATION, DISASTERS, PRODUCTS, and RESOURCES. The main content area is titled "Mexico City Earthquake 2017" and includes a "Disaster Types" section with "Earthquakes" listed. The "Overview" section describes a 7.1 magnitude earthquake in the Puebla state of Mexico on September 19, 2017. The "Latest Updates" section features a "Sentinel-1 Interferogram for September 2017 Raboso-Puebla Earthquake in Mexico" with a map and a "Read More" link.

NASA Earth Science
DISASTERS PROGRAM

NASA Applied Sciences Program | www.nasa.gov

Search

ORGANIZATION DISASTERS PRODUCTS
RESOURCES

Mexico City Earthquake 2017

Mexico City Earthquake 2017

Disaster Types

Earthquakes

Start Date

September 19, 2017

Overview

On September 19th a 7.1 magnitude earthquake occurred in the Puebla state of Mexico, approximately 75 miles from Mexico City. It impacted a large expanse of the country and caused over 200 fatalities and 1300 injuries. Extensive damage to buildings and infrastructure has also been reported. As of 6am on September 20th, over 24 aftershocks have been reported.

The NASA Disasters Program is supporting this event and is coordinating with US response agencies. We are also in contact with CENAPRED and AEM of Mexico and plan to support by providing landslide susceptibility models and radar based deformation and damage assessment products

Image Credit: USGS
(<https://earthquake.usgs.gov/earthquakes/eventpage/us2000ar20#shake-map>)

Latest Updates

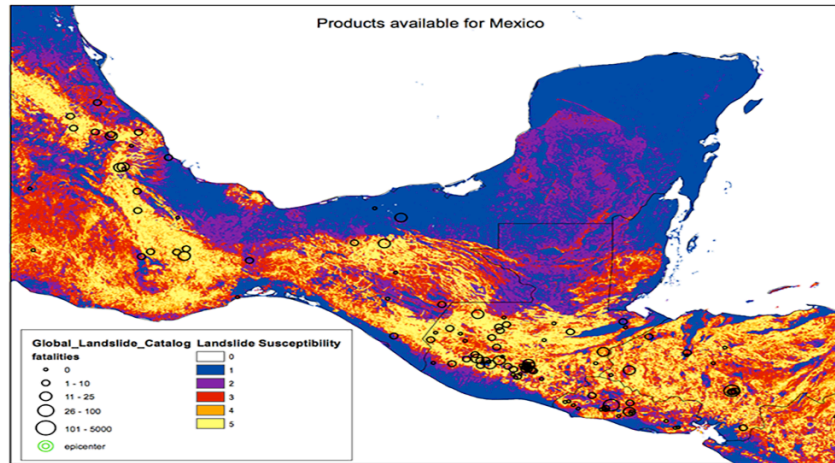
September 21, 2017

Sentinel-1 Interferogram for September 2017 Raboso-Puebla Earthquake in Mexico

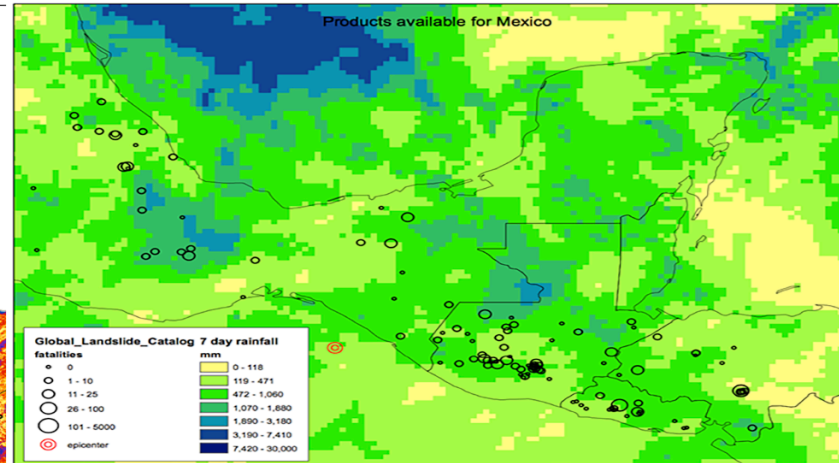
NASA and its partners are contributing important observations and expertise to the ongoing response to the September 19, 2017, magnitude 7.1 Puebla earthquake in Mexico. This earthquake has caused widespread building damage and triggered landslides throughout the region, including Mexico City. Scientists with the Advanced Rapid Imaging and Analysis project (ARIA), a collaboration between NASA's Jet Propulsion Laboratory, Pasadena, California, and the...

<https://disasters.nasa.gov/mexico-city-earthquake-2017>

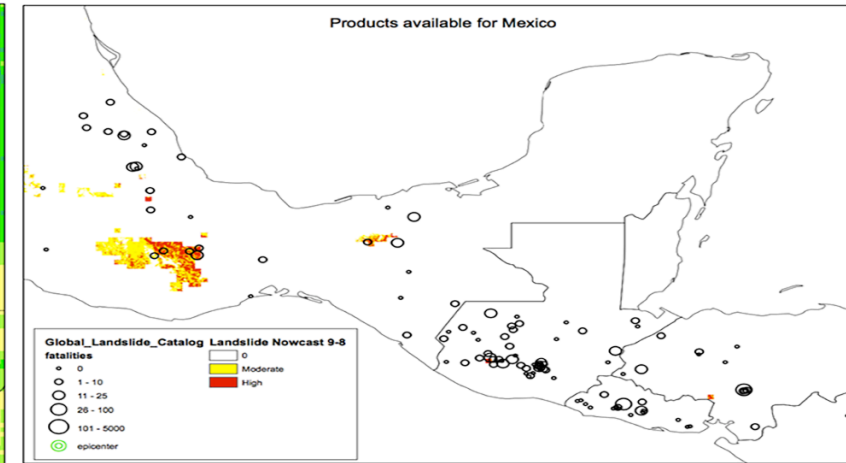
Landslide Models



The global Landslide Hazard Assessment for Situational Awareness (LHASA) model is developed to provide situational awareness of landslide hazards for a wide range of users.



Precipitation is a common trigger of landslides. The GPM Integrated Multi-satellite Retrievals for GPM (IMERG) data shows recent precipitation, updated every thirty minutes.



A LHASA landslide “nowcast” is created by comparing GPM data from the last seven days to the long-term precipitation record provided by the Tropical Rainfall Measuring Mission (TRMM) Multi-satellite Precipitation Analysis (TMPA).



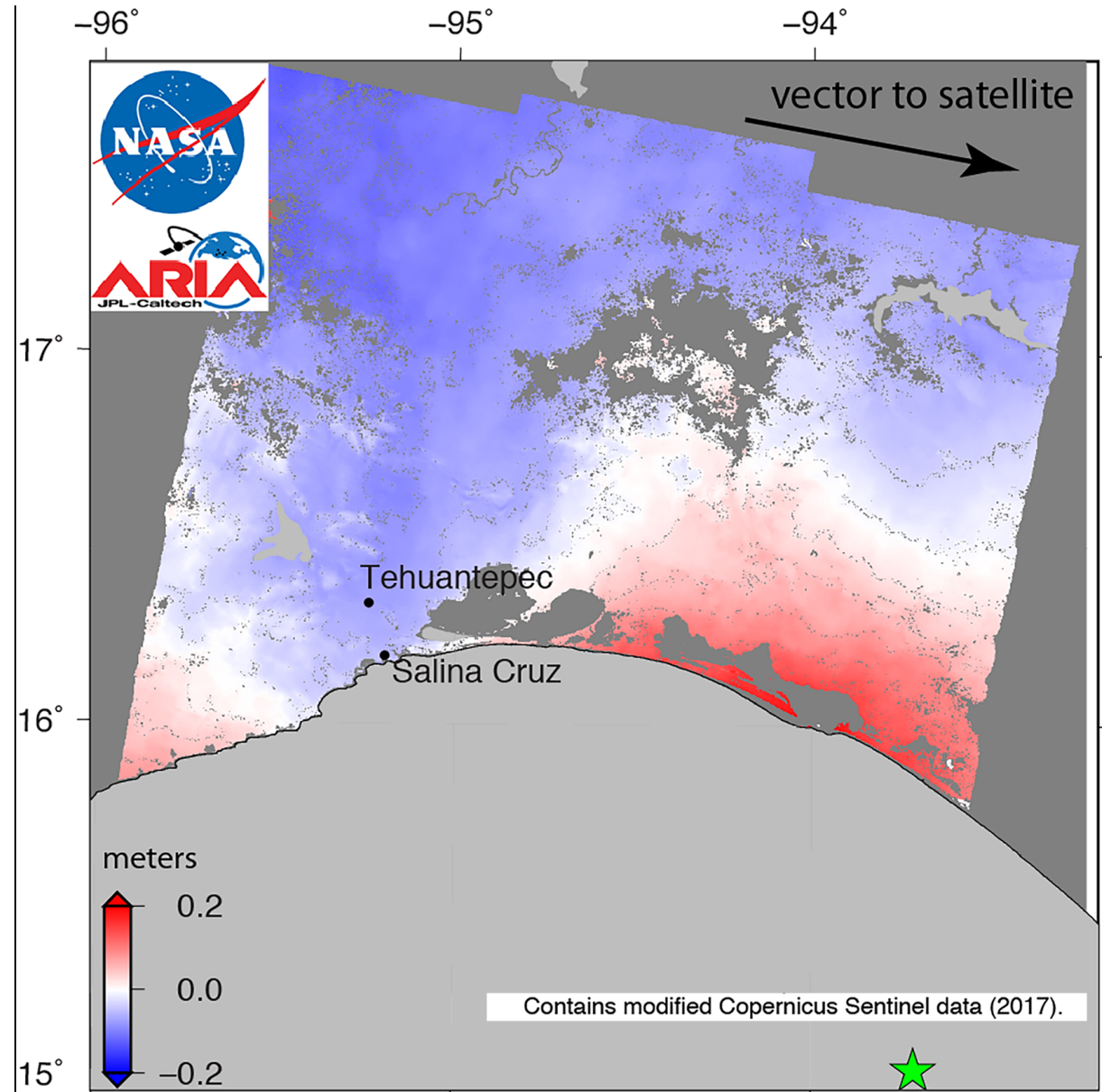
Products generated by the Disasters Program were used by AEM in collaboration with other government agencies in Mexico to make appropriate decisions for mapping damage, rescue and recovery, and informing the population regarding areas prone to potential risk.

CENAPRED analyzed the landslide susceptibility and nowcast data and integrated them into their "National Risk Atlas" visualization system.
<https://disasters.nasa.gov/mexico-earthquake-2017/landslide-maps-2017-mexico-earthquake>

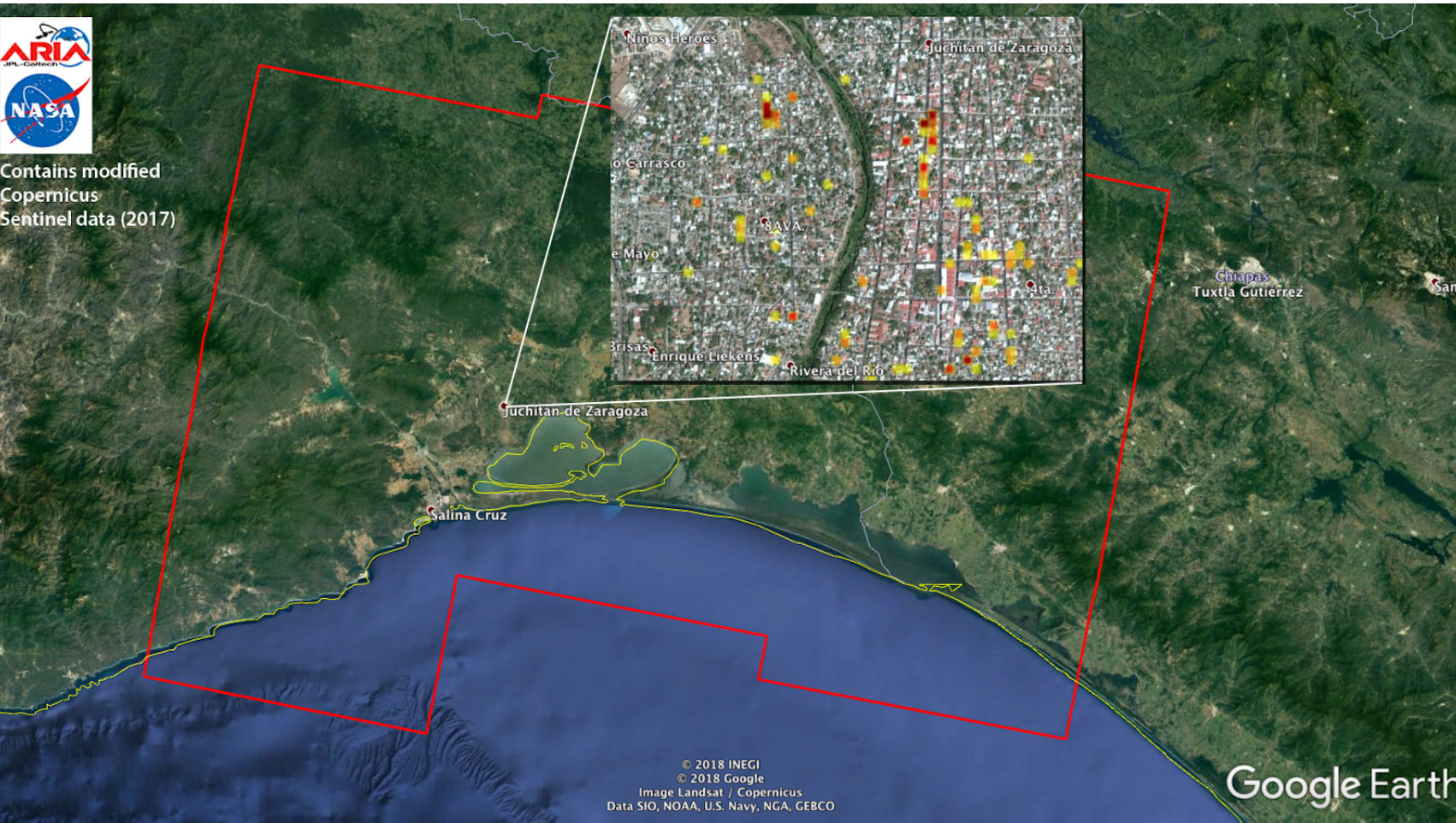
ARIA Deformation Map of Tehuantepec Earthquake

Scientists with ARIA analyzed interferometric synthetic aperture radar images from the radar instrument on the Copernicus Sentinel-1A and Sentinel-1B satellites, operated by the European Space Agency (ESA), to calculate maps of the deformation of Earth's surface. This false-color map shows the amount of permanent surface movement caused almost entirely by the earthquake, as viewed by the satellite, during a 6-day interval between radar images acquired by the two Sentinel-1 satellites on September 7 and September 13, 2017.

<https://disasters.nasa.gov/mexico-earthquake-2017/sentinel-1-radar-shows-ground-motion-due-september-2017-oaxaca-chiapas>



ARIA Damage Proxy Map of Tehuantepec Earthquake



ARIA created this Damage Proxy Map (DPM) depicting areas of Southern Mexico that are likely damaged as a result of the Chiapas earthquake, shown by red and yellow pixels.

The color variation from yellow to red indicates increasingly more significant ground surface change. Preliminary validation was done by comparing to optical satellite imagery by the DigitalGlobe.

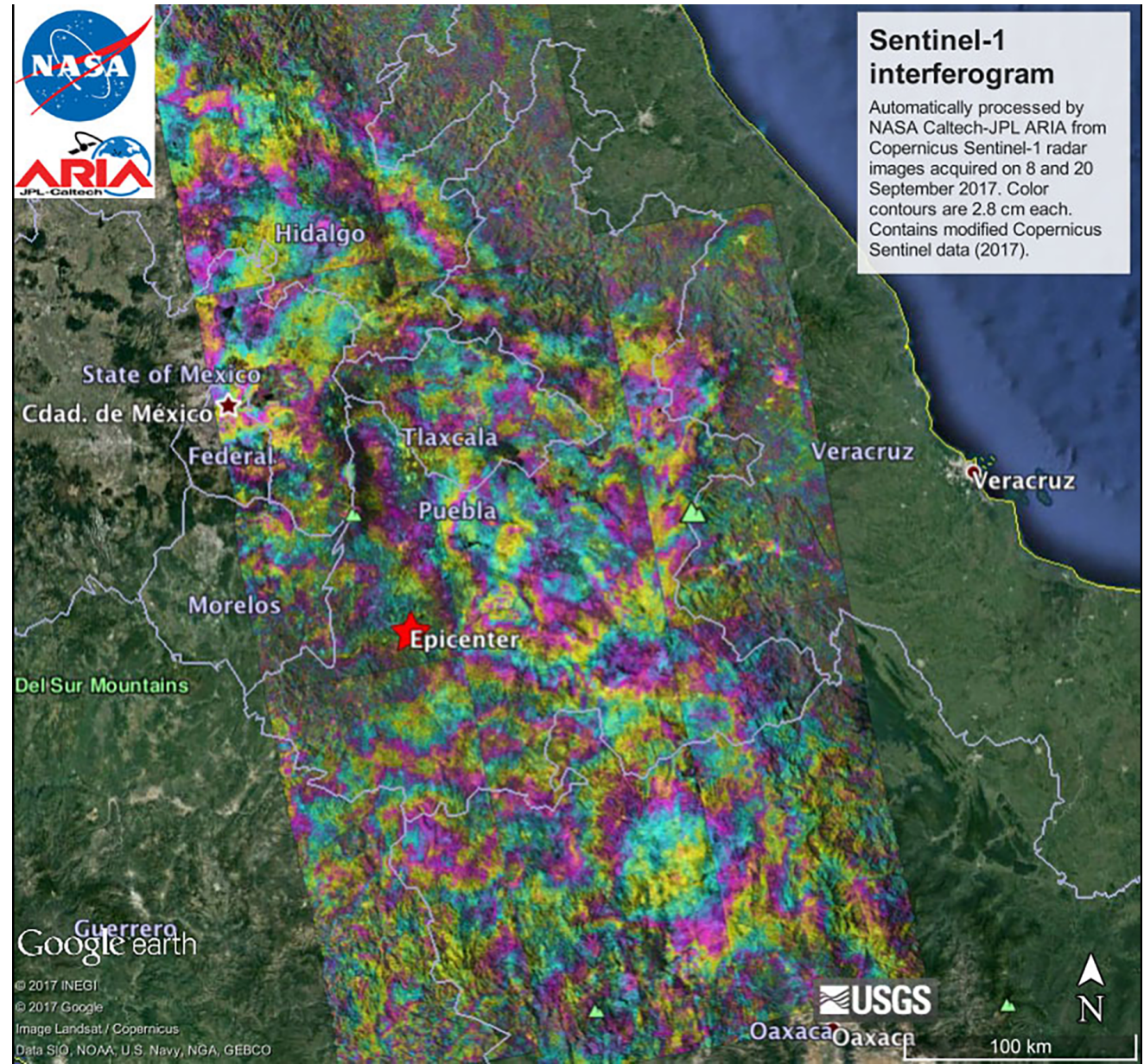
ARIA scientists analyzed images from the radar instrument on the Copernicus Sentinel-1A and Sentinel-1B satellites, operated by the European Space Agency (ESA), to calculate maps of the damage caused by the earthquake.

<https://disasters.nasa.gov/mexico-earthquake-2017/satellite-radar-detects-damage-caused-september-2017-m81-chiapas-earthquake>

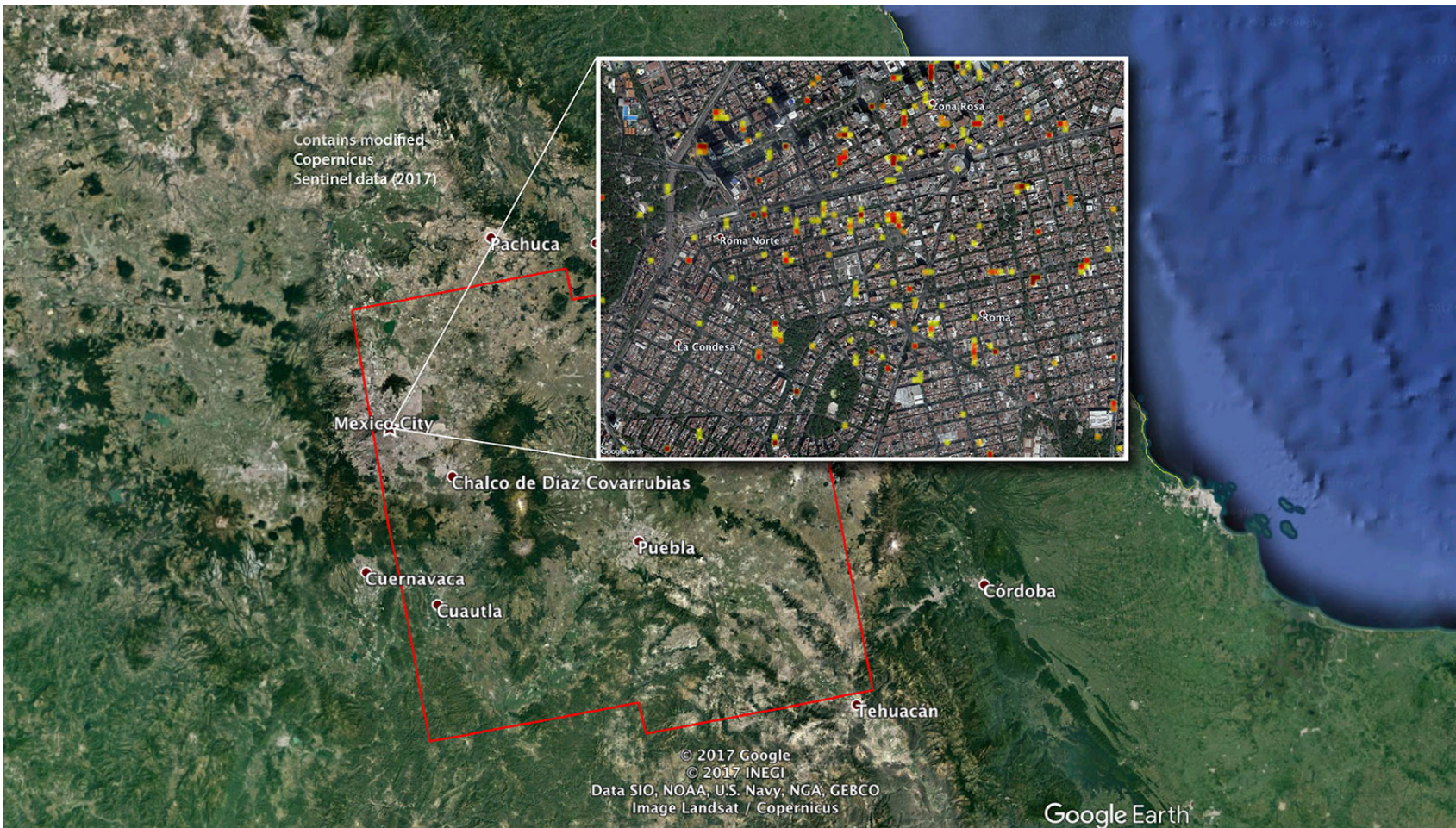
ARIA Interferogram of Puebla Earthquake

ARIA scientists analyzed interferometric synthetic aperture radar images from the radar instrument on the Copernicus Sentinel-1A and Sentinel-1B satellites, operated by the European Space Agency (ESA), to calculate maps of the deformation of Earth's surface. Surface displacements are seen as color contours, where each color cycle represents 1.1 inches (2.8 centimeters) of surface motion. The contours show there was broad deformation at the surface around 1-2 inches (3-5 cm) and there were no major surface ruptures due to the earthquake at 30 miles (50 km) depth. Scientists use these maps to build detailed models of the fault slip at depth and associated land movements to better understand the impact on future earthquake activity.

<https://disasters.nasa.gov/mexico-city-earthquake-2017/sentinel-1-interferogram-september-2017-raboso-puebla-earthquake-mexico>



ARIA Damage Proxy Map of Puebla Earthquake



This image is a Damage Proxy Map (DPM) depicting areas of Central Mexico, including Mexico City, that were likely damaged (shown by red and yellow pixels) from the magnitude 7.1 Raboso earthquake.

The color variation from yellow to red indicates increasingly more significant ground surface change. Preliminary validation was done by comparing the DPM to a crowd-sourced Google Map

ARIA scientists analyzed images from the radar instrument on the Copernicus Sentinel-1A and Sentinel-1B satellites, operated by the European Space Agency (ESA), to calculate maps of the damage caused by the earthquake.

<https://disasters.nasa.gov/mexico-city-earthquake-2017/aria-damage-proxy-map-m71-raboso-mexico-earthquake>

Letter of Thanks from the Mexican Space Agency



"Año del Centenario de la Promulgación de la Constitución Política de los Estados Unidos Mexicanos"

General Direction
Mexican Space Agency
Mexico City, 6 October 2017

National Aeronautics and Space Administration

On behalf of the Mexican Space Agency I wish to express my most sincere gratitude and appreciation to the National Aeronautics and Space Administration for the support by providing the spatial data related to the earthquakes experienced in Mexico in September 2017, where several regions of our country including Mexico City were severely damaged.

Your valuable contribution through NASA Earth Science Disaster Program, made it possible -in collaboration with other government agencies of Mexico- to take the appropriate decisions for mapping damage, rescuing and eventually recovery of the damage, as well as to address and inform to the population about the affected zones and the areas prone to further risk.

Again, we appreciate your interest and efforts provided by the National Aeronautics and Space Administration to support Mexico.

Sincerely yours,

Dr. Francisco Javier Mendieta Jiménez
General Director

**The Disasters Program
provided
government agencies in
Mexico
with products that helped
inform decisions for
response and recovery.**

From the General Director of AEM:

“Your valuable contribution through the NASA Earth Science Disaster Program made it possible – in collaboration with other government agencies in Mexico – to take the appropriate decisions for mapping damage, rescuing and eventually recovery of the damage, as well as to address and inform to the population about the affected zones and the areas prone to further risk.”

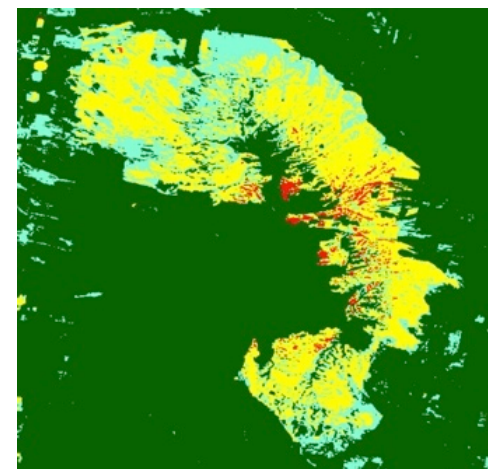
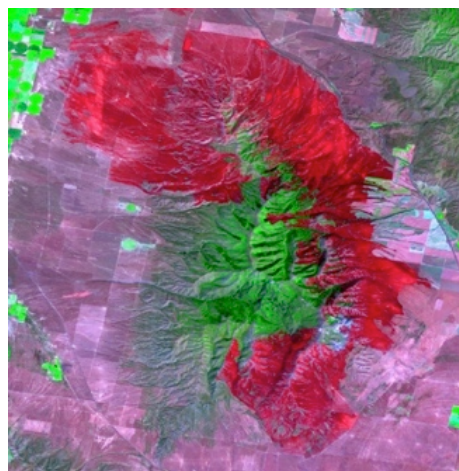
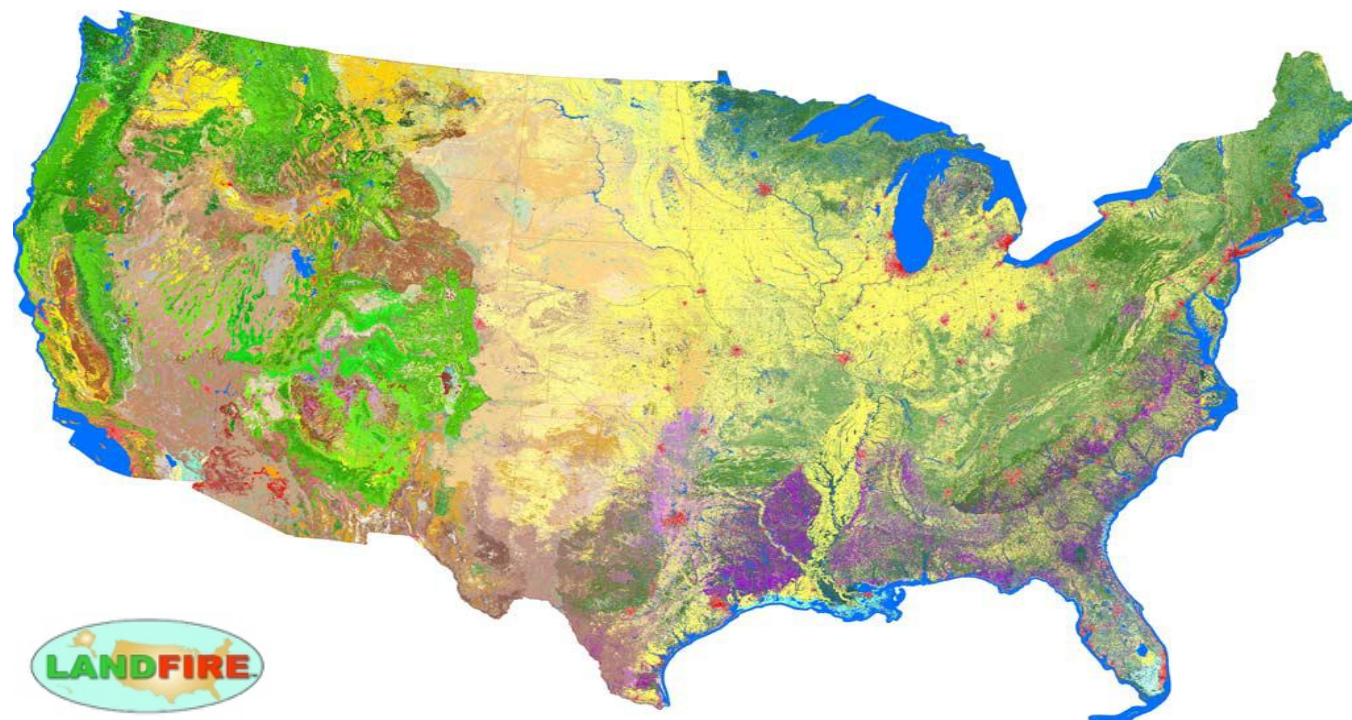


Wildfires

NASA Applied Science: Wildfires

Nine (9) Projects Supporting Wildfire EO

- Pre-Fire Mapping
 - Vegetation density and extent
 - Soil moisture/drought severity
 - Topography
- Active Fire Mapping
 - Total area currently burning
 - Fire Radiative Power (FRP) using thermal bands
- Post-Fire Mapping
 - Total area burned
 - Burn severity
 - Post-fire vegetation regrowth (NDVI)

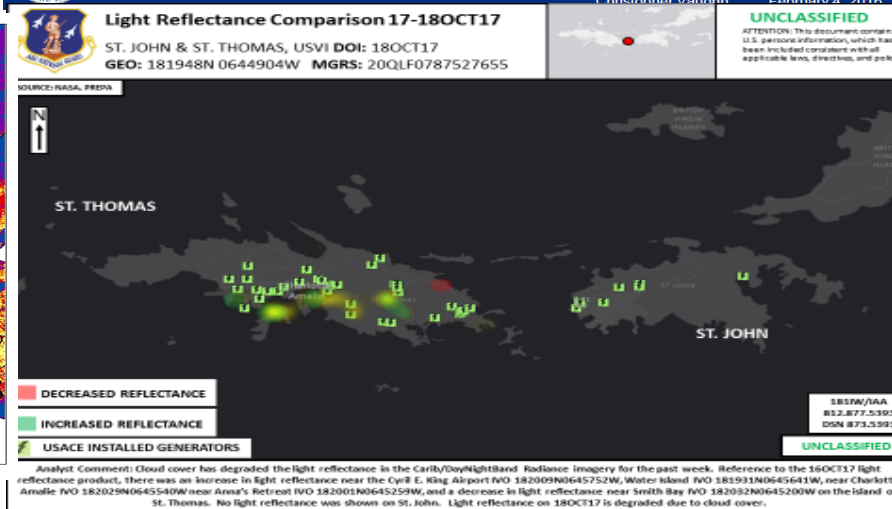
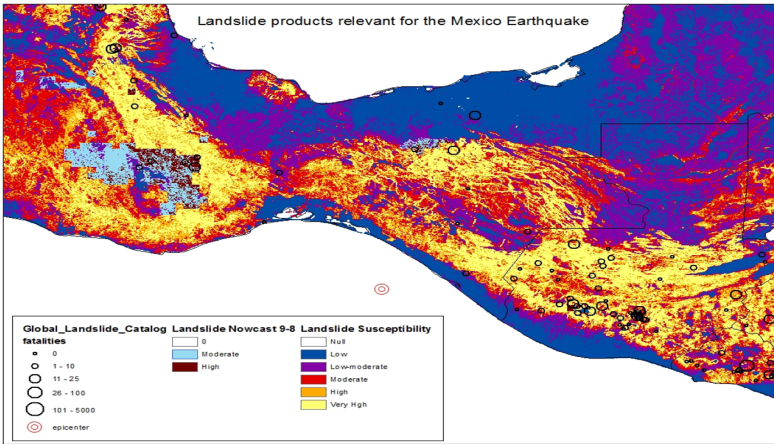
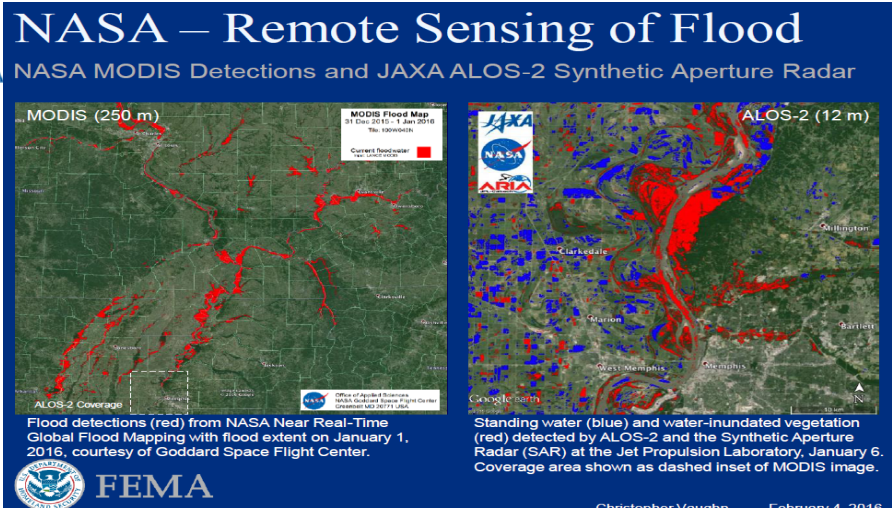
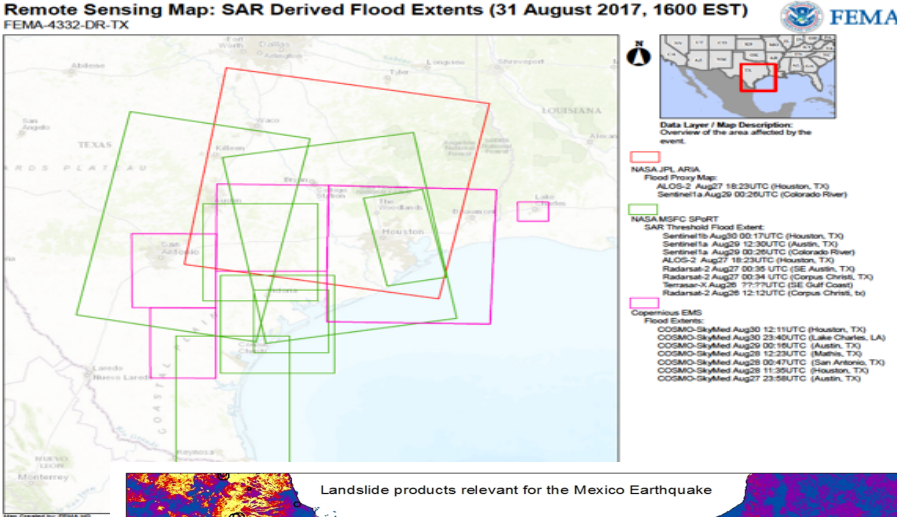


Above: A USGS Landfire map.
Left: 2007 Black Pine 2 Fire, Idaho, U.S. On the left: imagery, right: burn severity. USDA RSAC.

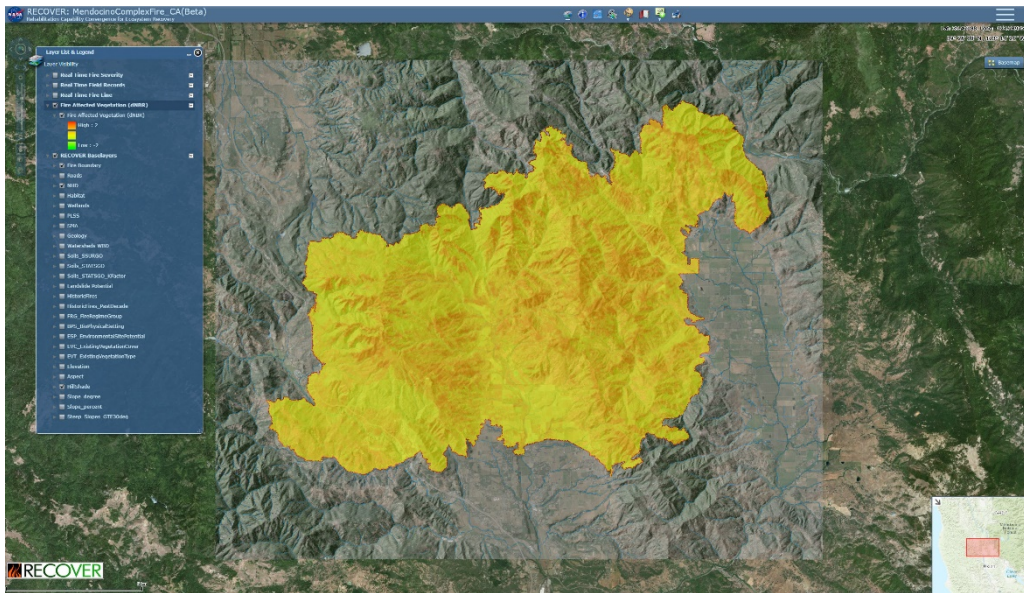
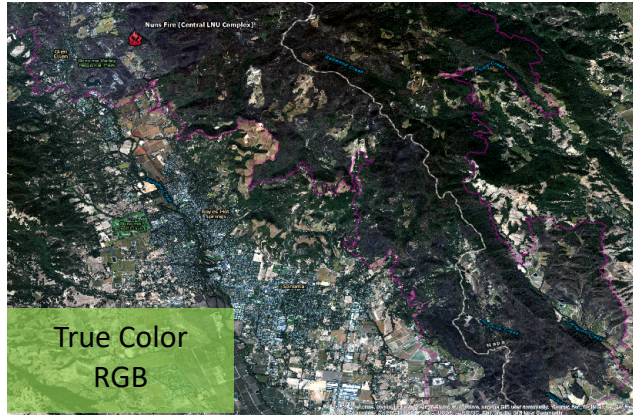
NASA Collaboration and Key Partnerships providing End-to-End Response

Using Multiple Sensors,
Models and Maps to
Answer Critical
Questions

Mobilizing Resources to
Assist Saving Lives and
Protecting Property



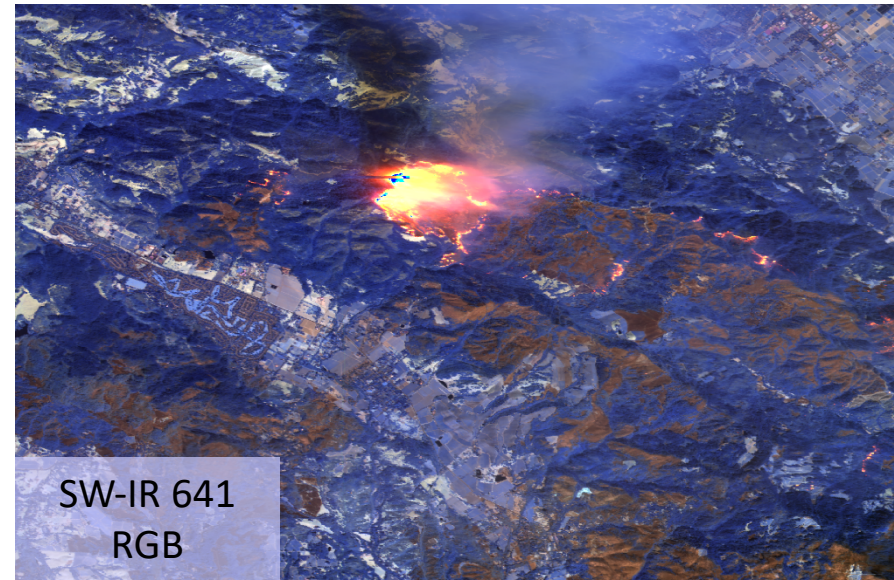
California Fires, October 2017



The NASA RECOVER DSS rapidly assembled dozens of GIS layers and earth observation imagery to provide fire fighters and managers with actionable information to respond to California's wildfires http://giscenter.isu.edu/research/Techpgg/nasa_RECOVER/
The DSS for the Mendocino complex of fires was available in 5 minutes with fire severity imagery (shown on the figure below) added shortly after.



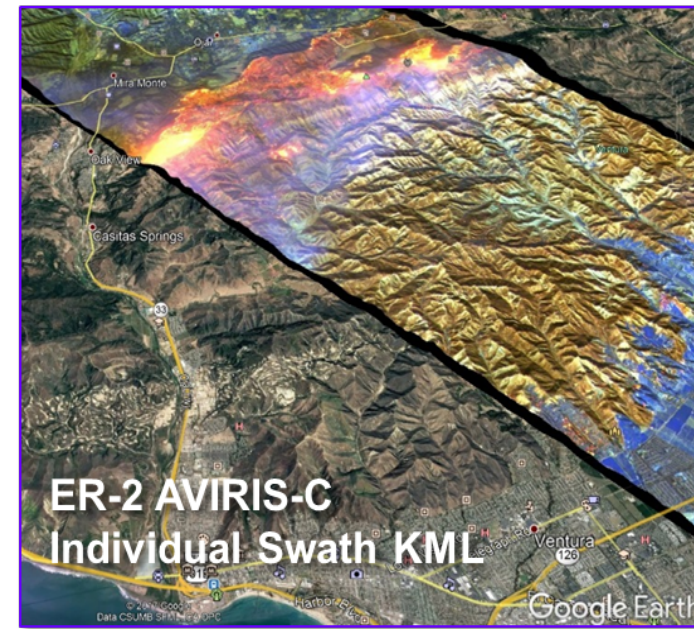
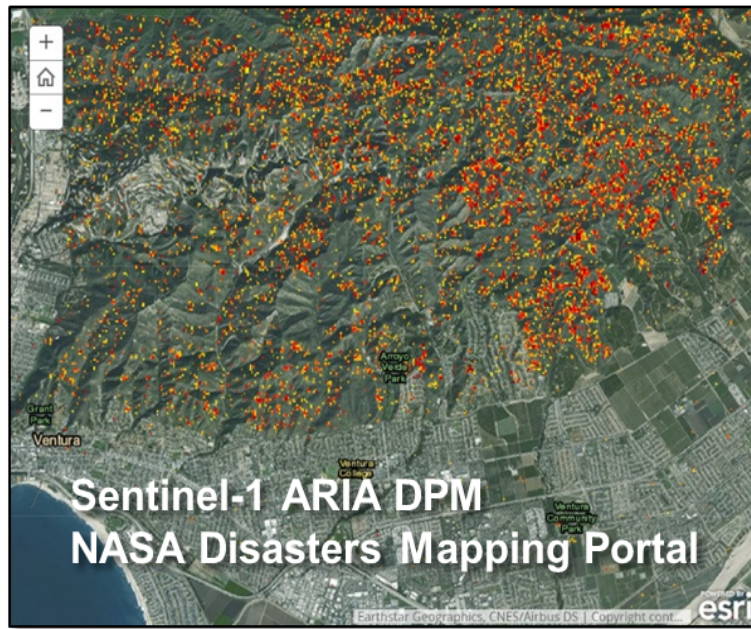
Digital Globe Worldview imagery RGB processed at
NASA Marshall from HDDS downloaded imagery



SW-IR 641
RGB

California Fires, December 2017

- Extreme Santa Ana winds contributed to outbreak of 10+ wildfires, including Thomas Fire (Largest officially recorded in California, 281,000 acres).
- NASA scientific data was available but required additional processing into useable formats requested by end users (CalOES, FEMA, NGB J2, CA ANG).
- This response served as a catalyst to improve Program ability to translate valuable scientific data into actionable geospatial information prior to disaster events occurring – ensuring all data we provide is useable and temporally relevant.
- Sentinel-1 ARIA DPM provided to CalOES ER-2 AVIRIS-C provided to NGB/CA ANG

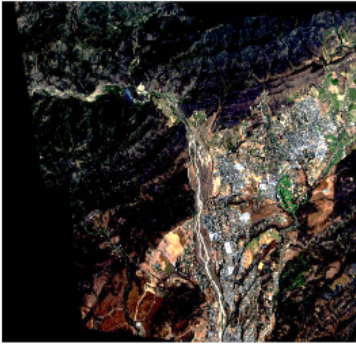


NASA Airborne Science Data

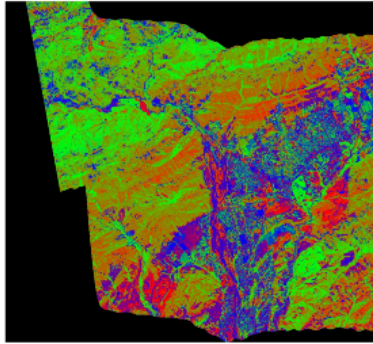
UAVSAR aboard NASA G-III aircraft imaged Napa County, California on October 16 to observe areas affected by several wildfires that started on October 8 and burned thousands of buildings as well as vineyards and forests.

6/28/17
Pre-Fire

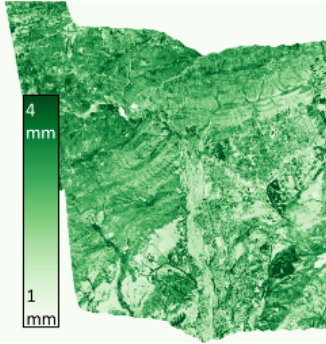
Visible image
(R: 650 nm G: 550 nm B: 450 nm)



Fuel load via spectrum fitting: Green Vegetation
NonPhotosynthetic Vegetation Soil / Rock

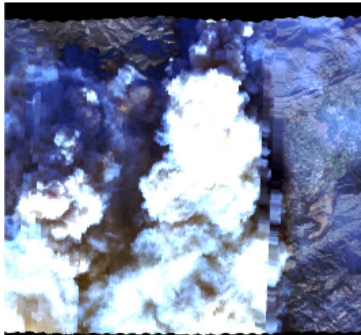


Equivalent Water Thickness (EWT) in
vegetation Canopies

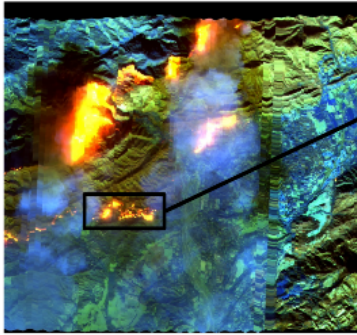


12/7/17
During Fire

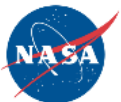
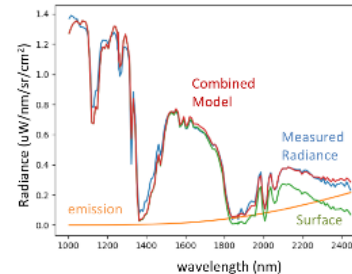
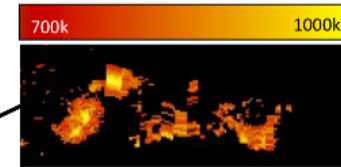
Visible image
(R: 650 nm G: 550 nm B: 450 nm)



Infrared image
(R: 2250 nm G: 1650 nm B: 1000 nm)



Fire temperature by spectrum fitting



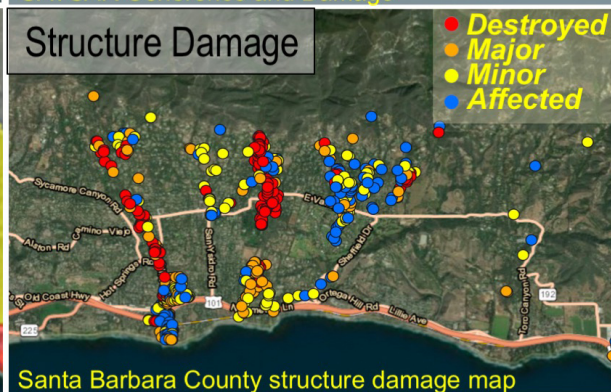
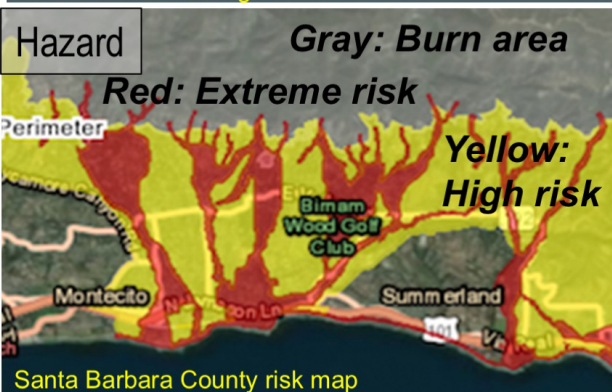
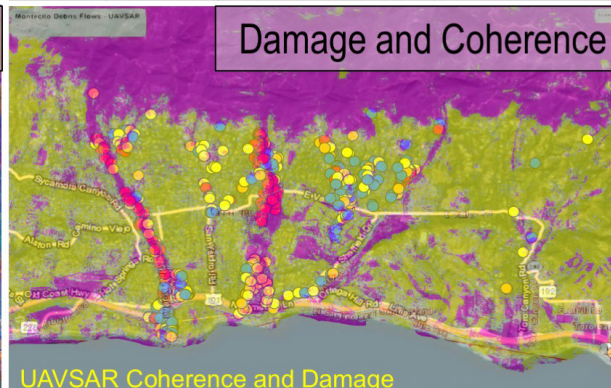
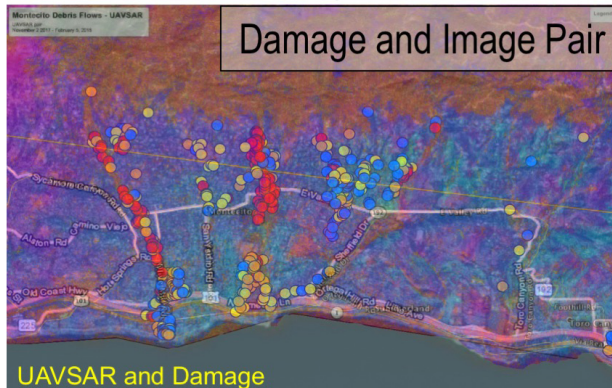
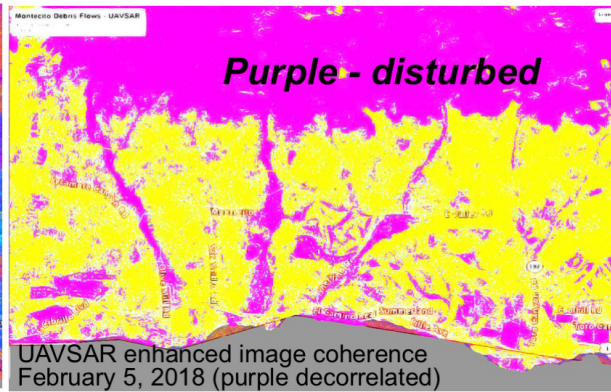
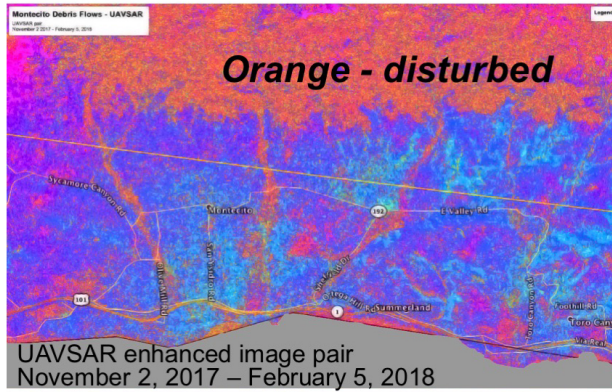
Spectroscopic Fire Measurements by the Airborne
Visible Infrared Imaging Spectrometer (AVIRIS)

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Montecito Debris Flows Observed with UAVSAR

Image Pair

Image Coherence



- Extreme winter rains in January 2018 following the Thomas Fire in Ventura and Santa Barbara Counties caused severe debris flows, destroying 73 homes and damaging over 160 structures in the town on Montecito, just east of Santa Barbara.
- NASA UAVSAR airborne radar platform detected changes caused by the debris flows between two images acquired on November 2, 2017 and February 5, 2018.
- An enhanced image pair (top left) show disturbed areas in orange. The two image pairs can't be matched and decorrelate in areas of severe surface disruption from the fire scar and debris flows (top right).
- In the middle panels the radar images are overlaid on the structure damage map produced by the County of Santa Barbara. The fire scars and damage correspond well with the risk map (lower left) and damage map (lower right).
- With an operational system, products such as this have the potential to augment the information available for search and rescue, and for damage assessment for government agencies or for the insurance industries.
- Radar has the advantage of being all-weather with the ability to image through clouds.

Donnellan, et al., 2018

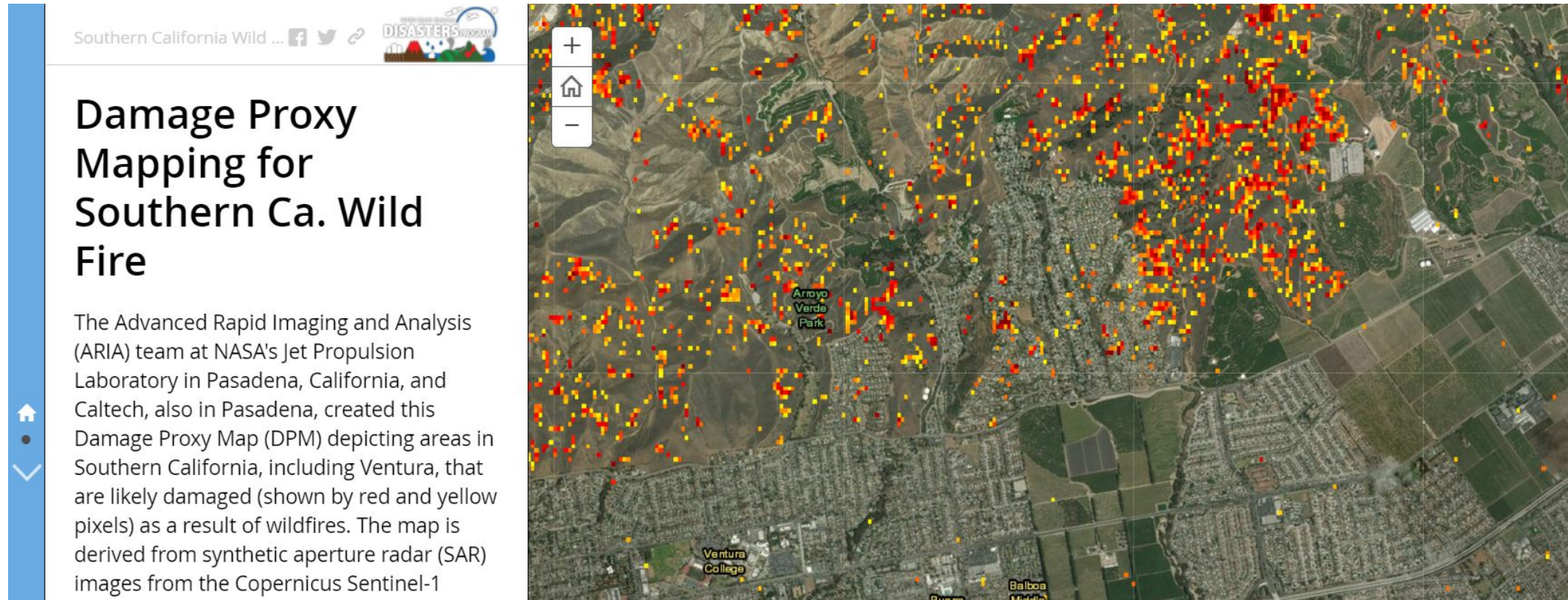
Geospatial Enablement & Data Delivery



*The Disasters Program is developing the Disaster Mapping Platform in order to provide **action-driven geospatial content and capabilities** supporting integration, analytics and collaboration across the disaster management landscape.*

<https://maps.disasters.nasa.gov>

Geospatial Enablement & Data Delivery



*The Disaster Mapping Platform **bridges the gap** between the NASA Science Communities' generated products and the disaster community that could benefit from the data.*



Acknowledgments

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Further Information

<https://appliedsciences.nasa.gov/programs/disasters-program>

<https://appliedsciences.nasa.gov/programs/wildfires-program>

<https://disasters.nasa.gov>

<http://geo-gateway.org>

<https://aria.jpl.nasa.gov>

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